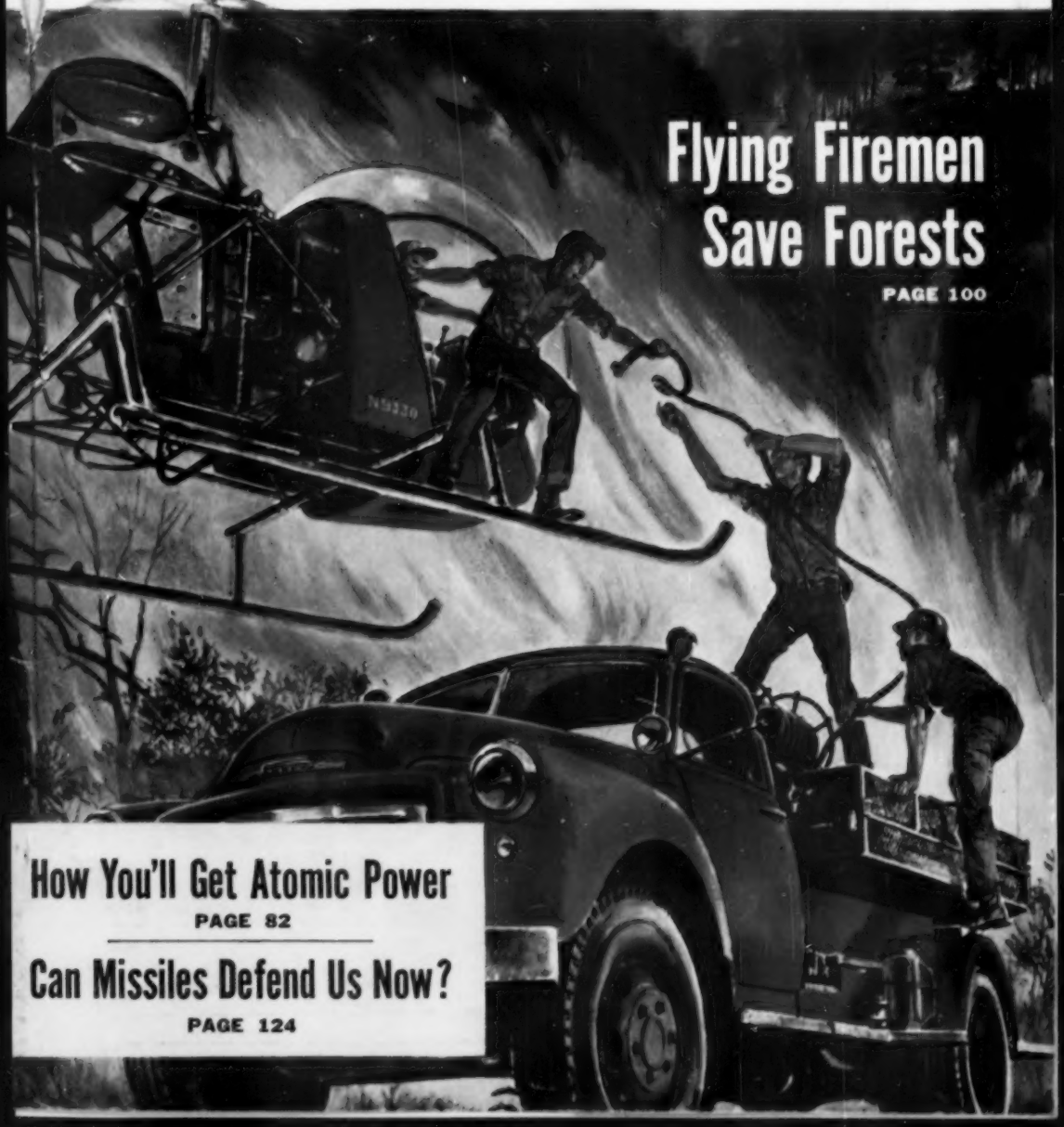
MECHANICS · AUTOS · HOMEBUILDING

POPULAR SCIENCE

August 35¢ MONTHLY



Flying Firemen Save Forests

PAGE 100

How You'll Get Atomic Power

PAGE 82

Can Missiles Defend Us Now?

PAGE 124

Cannot channel

Easy to clean

Filters out all dirt

Traps moisture

Saves detergents

Reduces friction

End Filter Replacement FOREVER!

with Revolutionary New Type

Micro BRONZE OIL FILTER

Rigid double-cone construction

Waterproof

Saves engine repairs

Unconditionally guaranteed

Easy to install

Saves oil

All-metal construction

Built-in acid neutralizer

Increases engine life

Never need replacing

Unaffected by pressure

Screens out abrasives

Efficient at all temperatures

Fits all cars

Eliminates acid

1. Eliminates Engine Acids
2. Traps Damaging Moisture
3. Filters all the Dirt
4. Reduces Friction
5. Saves the Detergents

U. S. Patent Appl. No. 464496

WHY GIVE YOUR ENGINE HALF-WAY PROTECTION? The Micro Bronze permanent all-metal filter with the built-in acid neutralizer is the world's first filter that guards against all *five* engine enemies: Acids, abrasives, friction, moisture and sludge.

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NAME _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

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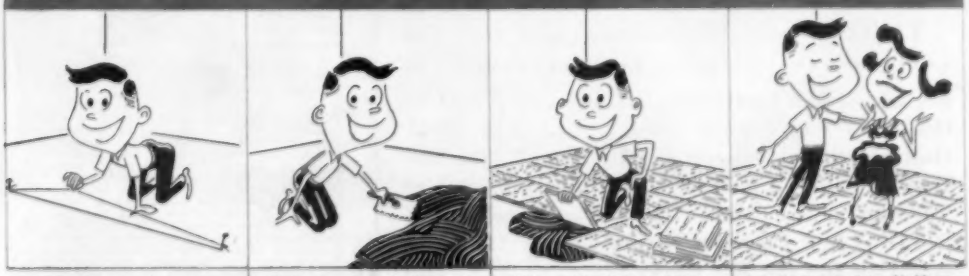

It's easy! Just mark a straight line through the center of your room in both directions, using a chalk and line. Be careful not to cover up your guide lines.

With a notched trowel, spread adhesive over one-half of your room at a time. Leave only a thin coat of adhesive on the floor.

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Vol. 167: No. 2

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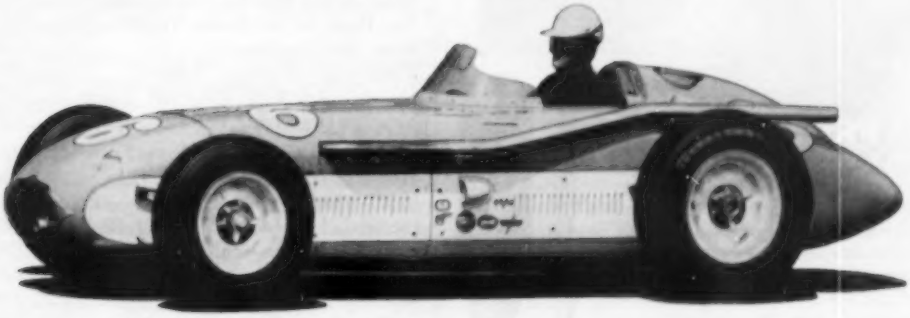

Champions score twenty-fifth victory in Indianapolis "500"! Bob Sweikert, with a winning average of 128.209 m.p.h., and *all other finishers* used Champions!

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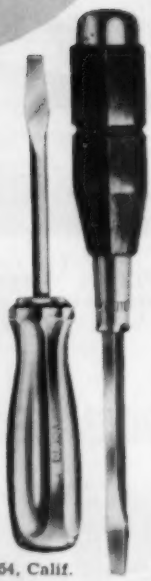

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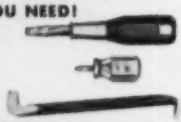

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How I foxed the Navy

by Arthur Godfrey

The Navy almost scuttled me. I shudder to think of it. My crazy career could have ended right there.

To be scuttled by the Navy you've either got to do something wrong or neglect to do something right. They've got you both ways. For my part, I neglected to finish high school.

Ordinarily, a man can get along without a high school diploma. Plenty of men have. But not in the Navy. At least not in the U. S. Navy Materiel School at Bellevue, D. C., back in 1929. In those days a bluejacket had to have a mind like Einstein's. And I didn't.

"Godfrey," said the lieutenant a few days after I'd checked in, "either you learn mathematics and learn it *fast* or out you go. I'll give you six weeks." This, I figured, was it. For a guy who had to take off his shoes to count above ten, it was an impossible assignment.

I was ready to turn in my bell-bottoms. But an ad in a magazine stopped me. Here, it said, is your chance to get special training in almost any subject—mathematics included. I hopped on it. Within a week I was enrolled with the International Correspondence Schools studying algebra, geometry and trig for all I was worth.

Came week-end liberty, I studied. Came a holiday, I studied. Came the end of the six weeks, I was top man in the class. Within six weeks I had mastered two years of high school math, thanks to the training I'd gotten.

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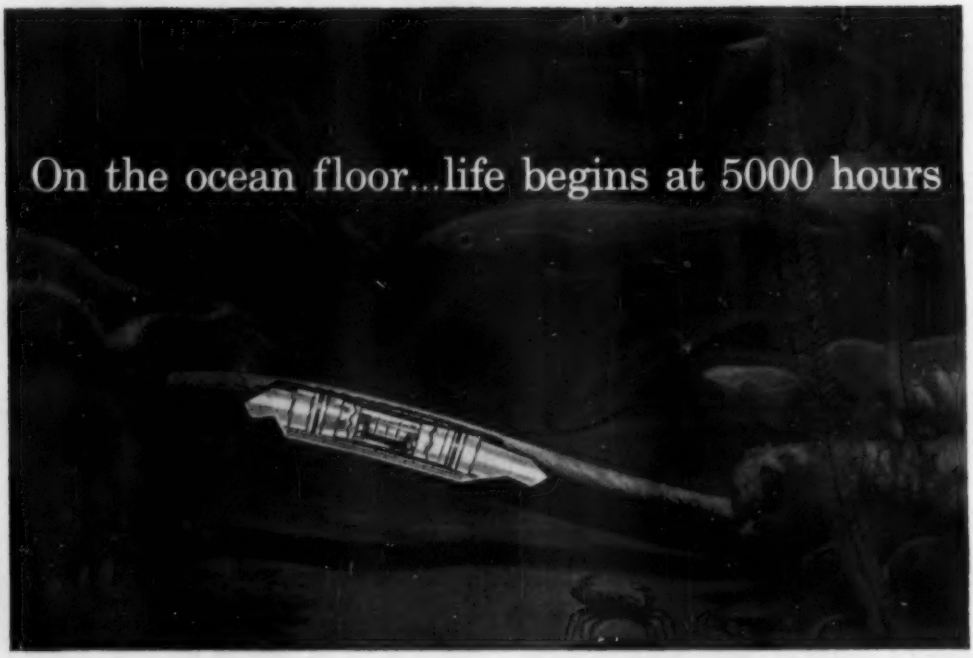

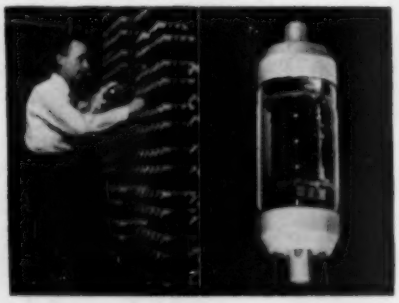

Electron tubes (right) for the Transatlantic Telephone Cable between Newfoundland and the British Isles are being handmade at Bell Laboratories. Life test bank is shown left. The cable system, which can carry 36 simultaneous conversations, is a joint enterprise of the American Telephone and Telegraph Company, the British Post Office and the Canadian Overseas Telecommunications Corporation.

When the world's first transoceanic telephone cable is laid across the Atlantic it will contain hundreds of electron tubes needed to amplify voices. Deep on the ocean floor these tubes must keep working, year after year, beyond reach of ordinary repair services.

Bell Telephone Laboratories scientists have developed a tube of unique endurance. Before a tube is even considered for use in the cable it is operated for 5000 hours under full voltage—more than the entire life of many tubes.

But survival alone is not enough. During the test each tube is exhaustively studied for behavior that may foreshadow trouble years later. Tubes that show even a hint of weakness are discarded. For the good ones, a life of many years can be safely predicted.

Bell Telephone Laboratories scientists began their quest for this ocean-floor tube many years ago. Now it is ready—another example of the foresightedness in research that helps keep the Bell Telephone System the world's best.

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Save $3 on Aeromat
FOUNTAIN BRUSH!

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This Hi-Pressure fountain brush is available to you direct from the factory—you save $3 as a result! Attach to your garden hose and wash your car sparkling clean in 7 to 10 minutes! Detergent pills (supplied with brush) go in brush head and a special rotary action gives you sudsy spray. Easy, simple! 3-ft. telescope handle. Silky Durostyrene brush. Complete kit only **1.98** Order No. 444

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tax & postage included.

Order No. 6

SWISS ARMY Type Knife
gives 10 tools in 1!

saw	awl
ice-pick	can opener
scissors	corkscrew
jackknife	small knife
screwdriver	bottle opener

No. 88

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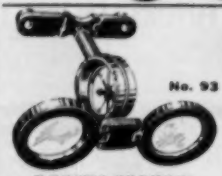

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These internationally famous binoculars-spectacles are now being sold at a price that only we, as exclusive importers can offer! Sold all over the U. S. & Canada for up to $5, this is the first and only time that Spectoscope has been offered at this low, low price. Wear 'em just like eyeglasses—use 'em for sports, nature, TV, reading, etc. 88c plus 12c handling. No. 90.

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from Solingen, Germany

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By Rimsky-Korsakov

[*Also available on 7-inch 45 rpm Extended Play Records]

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Letters

PNDLR or PRNDL?

For heaven's sakes, what's the matter with those automobile designers? Why can't Ford and Chevrolet agree on where reverse gear ought to be on automatic cars? I'm used to a Chevrolet, and this afternoon I borrowed my boy friend's Ford to do an errand, and I put it in reverse to back out and went for-

ward with an embarrassing crash. My boy friend's mad at me.

CHARLOTTE MULLIGAN, New York

We think you have a point. There are five different shift patterns on 1955 cars: PNDLR on Chevrolet, Buick and Studebaker; PRNDL on Ford, Mercury and Lincoln; RNDL on Plymouth, Dodge, DeSoto and Chrysler; ND_1D_2LR on Cadillac, Oldsmobile, Pontiac, and Hudson and Nash Sixes; and PND_1D_2LR on Packard, and Nash and Hudson V-8s. Each manufacturer will tell you volubly how his is the sensible, safe, convenient arrangement, and everyone else is out of step. The variation isn't a problem for a one-car driver, but does cause annoyance in two-car families and to parking-lot guys.

Unwarranted Reflection on Propane

The article regarding "Smoke-Eating Cats" [June, p. 83] was extremely interesting, as is any progress in the elimination of smog. However, the impression many readers will get from the first picture is that a propane-gas flame usually gives off "noxious carbon monoxide." An improperly adjusted burner will do this with any of many fuels.

I have been working with propane for

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Now at last a well-known expert has taken the mystery out of radio and TV repair! In this amazing new manual he tells you, in non-technical language, how to fix almost *any* radio or television set. Right from the very first chapters you can start doing simple repairs. And before you are half way through the book you'll be able to fix HALF the television and radio sets you encounter. In just a few weeks you can start fixing your own and friends' sets . . . get a service shop job . . . even start your own money-making business at home.

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over 21 years and I feel that this is an unfortunate and unwarranted reflection on one of the safest fuels ever developed.

JOSEPH E. PULLING, Dover, N. J.

No slight to an excellent fuel was intended. The picture was arranged to demonstrate how the catalysts could consume unburned gas, whether propane, carbon monoxide or some other type.

Adhesive Is Adhesive from Now On

I was amused to see that someone else caught your misuse of "gunk"—trademark for a grease remover—to mean counter-top adhesive [Letters, May, p. 16].

I was even more amused, however, to note the words you promised to use in the future. I'll go along with "stickum," "goo" and even "glop," but did you know that "goop" is the trade name for the mainstay of a do-it-yourself kit for making sundaes at home? As I recall, it comes in three flavors.

CURTIS G. MCCRADY
University of New Hampshire, Durham N.H.

. . . You flubbed again. "Goo" is the name of an adhesive used by model railroaders. It will hold anything, but a counter top is a little beyond the scope of the 35-cent tube.

EDDIE MILLER, Shelley, Idaho

He Wants Economy, Not Power

I found Mr. Rowsome's article, "What Horsepower Really Means" [April, p. 126], very informative until I came to the concluding paragraphs. He says the big new engines do not cost more gas. Why, he would have us believe that a Percheron doesn't eat more oats than a Shetland pony. . . His qualifying "if you drive your '55 the same as your '41" doesn't hold water. If you've got all that oomph, you're going to use it.

The next paragraph claims that the new hopped-up cars don't really go so much faster than the older ones did. But the new buggies get up to 90 so easily that it's just human nature to keep that accelerator mov-

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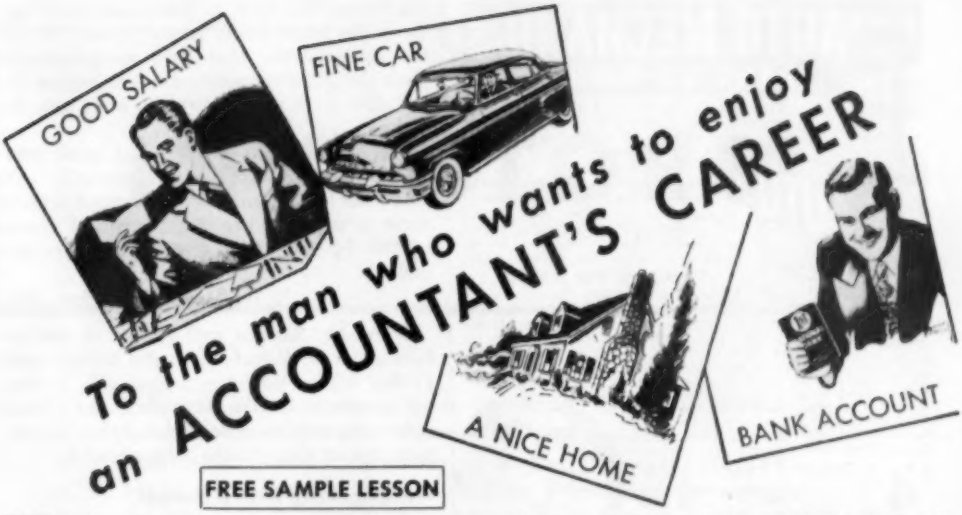

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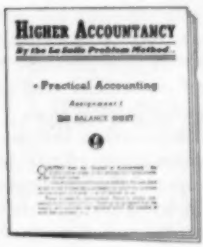

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ing toward the floor. . . The more speed you have, the more you're going to use. It's for the same reason that soap manufacturers push the giant economy size—the bigger the box, the more you're going to pour into the dishpan.

I think the auto industry has gone completely nuts. Why make 120-m.p.h. cars when the maximum speed permitted in most states is around 50 to 60? Instead of giving us 200 hp., why not give us 20 miles per gallon?

E. N. Blonien, Chilton, Wis.

If reader Blonien will glance at the article again, he'll find that it did indeed state 1) that higher power may cost gas, 2) that top speeds are somewhat higher, and 3) that older cars, also capable of dangerous speeds, were not as deceptively calm about it.

Wallpapering with a Broom

Since I seldom need to put up wallpaper, I didn't want to buy special tools. But I found practical substitutes right in the house. A new and unused push broom became a wallpaper smoothing brush (I used

it without the handle, except for the ceiling). A hardwood caster borrowed from a table leg made a good seam roller. For a trimmer, my wife had a small pronged-wheel gadget (used to perforate paper dress patterns), which did the trick. With a kettle for a paste pot and a dust brush for a spreader, I was able to do a surprisingly neat job of papering.

A. B. Vierhaus, New York City

Praise for Gentleman Jim

Congratulations to you for your splendid article, "He's America's No. 1 Sports-Car Driver" [June, p. 116]. It is a pleasure to read a story that places objectivity and accuracy before sensationalism.

Unfortunately, not mentioned in the story are Jim Kimberly's unremitting efforts for the furtherance of the sport. He has organized and administered schools for new drivers, planned racing events, and generously

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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Submarine Sightseeing?

May I offer a suggestion for that New-World Fair proposed in Florida [Apr., p. 164]? Why not develop passenger sightsee-

ing submarines to travel the lagoon of the Fair? It would provide a novel experience for visitors.

Pvt. John P. Zampini
5th Infantry Division, APO, N. Y.

Call the Fire Department First

On page 198 of the April issue you have a picture of a garden hose in a house ready for use in case of fire. Fine as far as it goes. But why not tell people to please call their fire department FIRST.

How bitter we get when we have a $10,000 loss due to a delayed alarm. Some homeowner tried to put out the fire only to see it get away from him. For a going fire in a stair well, a garden hose just can't put out the necessary amount of water.

Every home should have some sort of first-aid appliance for fires. Just like first-aid materials for accidents. But they should not be substitutes for the fire department or doctor.

Lt. James L. Hoose
Arcade Fire Dept., Sacramento, Calif.

How to Shift a No-Shift Car

I keep getting conflicting advice on how to handle the automatic transmission in my '55 Ford. When waiting in a long line of stalled traffic, should I shift back to Neutral or leave it in Drive? When parking, is it better to set the brake, or push the lever to Park and leave the brake off?

O. H. Behrns, Oakland, Calif.

An automatic-transmission car compelled to wait in traffic for more than a few seconds should by all means be moved from Drive to Neutral. It is safer as well as easier on the engine and fuel bill. When parking, always set the brake. If your transmission seems to stick in Park, set the brake first; then move the lever to Park.

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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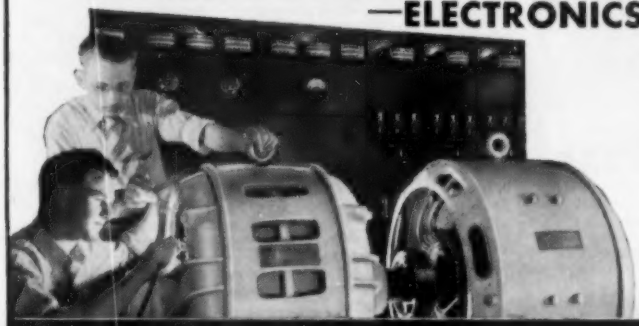

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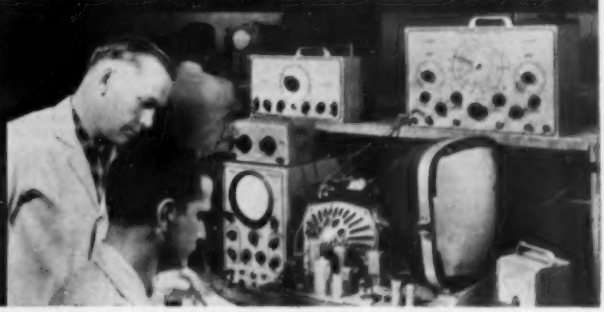
(Right — Instructor helping students check the wiring and trace circuits of television receivers.)



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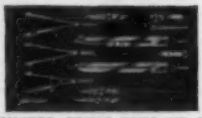

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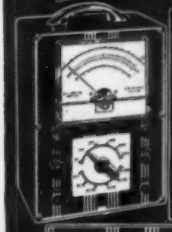

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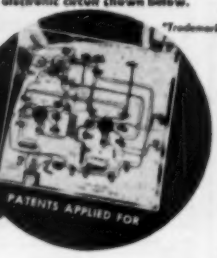

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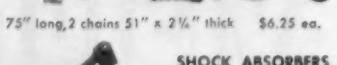

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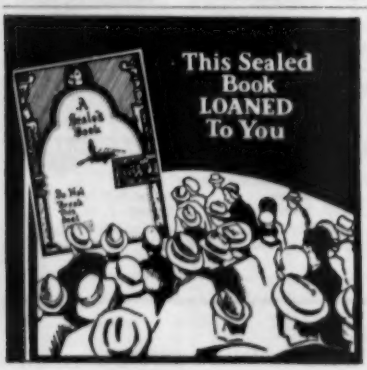

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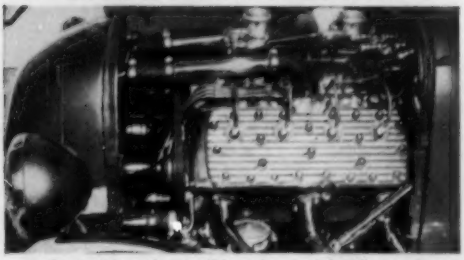

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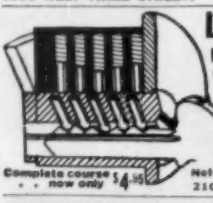

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700-16	5.75	760-15	5.45	750-17	10.35	825x20	16.65
750-16(6)	7.55	800-15	5.75	825-15	12.95	900-20	15.55
550-18	4.55	820-15	5.75	600-20	8.05	1000-20	15.75
550-17	3.75	670-16	5.35	650-20	8.35	1100-20	17.45
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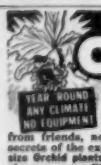

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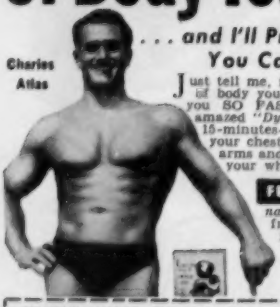

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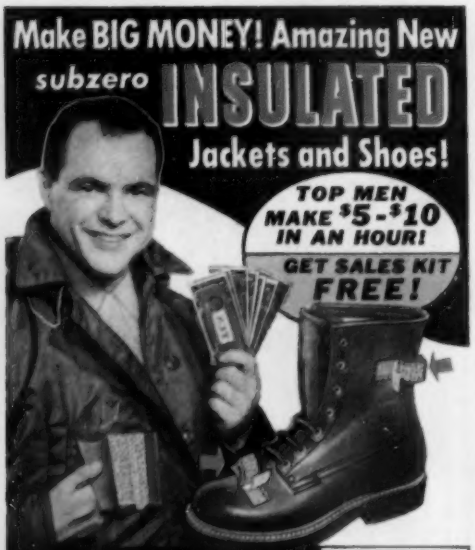

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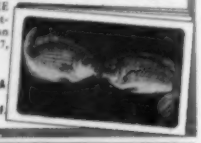

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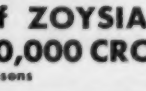

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ELECTROPLATE autoparts, novelties, mirrors, baby shoes. Easy, inexpensive home processes. Free booklet. Tyco Metals, Box 13231-CQ, Houston 19, Texas.

DEALERS for Exclusive Non Competitive Business. Earn $200—$300 a week. No investment. Write M.W., Inc., Dept. SC, Boston 14, Massachusetts.

MAKE money with your tape recorder. Free details. Kathbon Enterprises—P.O. Box 80, Beaver Dam, Wisconsin.

MONTHLY repeat business which you can operate in your own community. For free details write Grasak, 321—28th Street, McKeesport, Pennsylvania.

LEARN Sewing Machine Repairing Differently. Original Money Plans. Surprisingly Odd! Booming! This Vocation! Send 20c Receive $1.00 Lesson Plus Details. Purdy's, Box 207-P, Weatherford, Texas.

$5-$10 AN Hour Teaching Driver Training in your own Car. Complete Detailed Information $1.00. Driving School Services, Box 4285, Goleta, California.

TIN-Cans. Turn them into cash. Nine methods. Instructions 50c. Charles Company, 12-EDN, Norwood, Ohio.

UNUSUAL opportunity hand spinning sparetime. Angora House, PSM, Springfield, Illinois.

WANT Up to $100.00 Weekly deposited in your mail box? Details Free! Smith, 2706-S Ladera, San Bernardino, California.

$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-36C, Oceanside, California.

BECOME Tax Consultant. Our students earn to $3,000 in 3-month season, parttime. Also operate lucrative year-round Business Tax Service. Experience unnecessary. We train you—help you start. State approved. Free literature. Union Institute, 68 Hudson, Hoboken 1A, N. J.

FREE Folio "Up to $45,000; Unlimited Vacations." No merchandise, equipment. Unknown! Work home—sparetime! Haylings-815, Carlsbad, Calif.

EARN $2.00 Hourly, making and selling Sandals! Youngs, 1308-PS, South First, Arcadia, California.

PRINT for Profit at home. Amazing new method prints colorful posters, banners, greeting cards, glassware—anything. Hundreds at time. No press needed. No art. Fantastic profits! Need representative your area immediately! Free home-business plan. Screen-Print, Dept. PS-8, Los Angeles 61, California.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen 1231-B East Third, Duluth 5, Minnesota.

INVESTIGATORS wanted. Work furnished. Build a business. National Correspondent Service, 518 New York Bldg, St. Paul 1, Minnesota.

MONEY in new greasless doughnuts. Start in kitchen. No smoke. Sell stores. Free recipes. S. Ray Co., 3605 South 15 Ave., Minneapolis 7, Minn.

$70 WEEKLY Guaranteed—home, spare time. Simplified mail Bookkeeping. Immediate income—easy! Auditax, 34757DQ Los Angeles 34.

EXTRA money sparetime sharpening farm discs. $20 to $25 daily profits. No dismantling—no moving. Simple portable machine sharpens whole disc right on farm. Free plan explains. B. M. Foley Co., Columbia Heights, Minn.

37A CLAIM INVESTIGATORS

INVESTIGATE Accidents! Many earn to $10,000 yearly. Thousands of insurance companies, airlines, and steamship lines need Claim Investigators. We train you at home spare time. Placement counsel and help. Free Book—Now! Universal Schools, Dept. B-8, Box 8202, Dallas 5, Texas.

38 MONEYMAKING OPPORTUNITIES

FREE! "301 Profitable Small Businesses!" Amazing shoestring plans! Work Home! Start Sparetime! Deumant Surveys, Kenmore, 23-T, New York.

MAKE money addressing envelopes sparetime. Glenway, 5713 Euclid, Cleveland 3, Ohio.

EARN Ready Cash doing mailing work—No experience needed—Y. Wilson Business Service, 2875 Glendale Blvd., Los Angeles 39, California.

MAN Wanted—Are you dissatisfied with your work? Would you like a business of your own? If so, write Rawleigh's, Dept. H-GG-PSC, Freeport, Illinois.

SPARETIME Profits Taking Subscriptions. All Magazines, Wholesale Catalog Free. Cassell Publishers, Westfield, N. J.

MAKE Money growing miniature trees on your window sill. Free seed and plan. National Nursery, Dept. GC, Inglewood 4, Calif.

HUSBAND-Wife successful in mail order business. Details free. Chas. S. Edwards, 5100A East Side Avenue, Dallas 14, Texas.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

NEW Comedy, religious, general 7" x 11" signs. 7c, retail 50c. 13 samples, $1.00. Lowy, 812 Broadway, Dept. 889, New York 3.

START A Buying Service, buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Postcard brings details. American Buyers', Hertel Station, Buffalo 16-O1, N. Y.

WHOLESALE Catalog! 30-80% Discounts! Typewriters, Appliances, Housewares, Watches, Jewelry, etc. Consolidated Distributors, 21-17 Lafayette, Paterson 15, New Jersey.

RUN Cafe, Diner. How to get started, menus, foods, revealed in home training. Write for Free book "Cafe, Diner Business." School of Restaurant Arts, BU48, Fremont, Ohio.

LEARN Technical metaphysics and insure your future. Easy, inexpensive correspondence course. Simplest method known. Diploma. Write: Premier College of Technical Metaphysics, 2532 McKenzie St., Vancouver, B.C., Canada.

MAKE Your Spare Time Profit Time! Over 600 beautiful, unusual gifts, greeting cards, household gadgets, toys, jewelry, baby items, and gift wraps you can sell to friends, neighbors, relatives. Write at once for big, bright Free Catalog just off the press. Samples on approval. Hurry—get details on sensational Christmas money making! Greetings Unlimited, 3704 Park Square, St. Paul 1, Minnesota.

SELL Titania Gems; far more brilliant than diamonds. Catalog free. Diamonite, 1404-S Mitchell, Oakland 1, California.

DOLLARS In Modern Baby Record Books, Baby Shoe Kits. Liebig Industries, Beaver Dam 57, Wisconsin.

YOU Cast Metal. Free Literature. Castings, Box 124, Lynwood, California.

$50,000.00 From One Small Ad. Details $1.00. AAA, San Antonio 9, Texas.

PIANO Tuning Pays. Learn this profitable profession at home easily with patented Tonometer and mechanical aids. No knowledge music necessary. Diploma granted. Write for booklet. Niles Bryant School, 3731 Stockton Blvd., Dept. S, Sacramento 20, Calif.

BUY Wholesale 450,000 Products. Literature Free. Carter, Box 6011-G, Chicago 80.

WANT to go in business for yourself without capital? We show you how. Start part time your own home. Postcard brings details absolutely free. Topval Corp., Lindenhurst 522, New York.

GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 179, 2954 Admiral Way, Seattle, Washington.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

MAKE to $4.50 hour doing common pen lettering. National Artists, 801½-C North Marsalis, Dallas 3, Texas.

$3.00 RETURNS $30.00. Particulars 25c. DraKene, 474 Sinclair, Atlanta 6, Georgia.

SELL Merchandise by mail. Everything supplied. Big profits. Details Free. Stull's Buying Service, 621 Adams Ave., Scranton, Pa.

ADDRESS envelopes at home. $25 weekly possible, sparetime. No selling. Temple Co., Box 946, Muncie 7, Indiana.

EXCEPTIONALLY Profitable Home Mailorder Business Plans. Lewis Bartlett, Richland, Georgia.

ADDRESS Envelopes at Home $50.00 Weekly Possible. National Industries, 33 Hyde Park Avenue, Jamaica Plain 30, Mass.

BALANCE engines, motors dynamically. Free literature. Box 124, Lynwood, California.

$124.50 Weekly. Sparetime. Homework. Guaranteed. $1.00. Amazing Science, San Antonio (9), Texas.

JEWELRY manufacturing at home without special tools or training. Professional results from the beginning. Make tremendous profits selling to your friends, stores, etc. Great variety of beautiful rhinestone, pearl and moonstone creations to select from. Small investment with all merchandise unconditionally guaranteed. You have started your own business when you send 25c for our fully illustrated catalog and other literature. A. V. Cutt Company, Inc., 210-H Fifth Avenue, New York 10, New York.

EXTRA money addressing mailing postcards. Gul, 2419 Thomas, Chicago 22, Illinois.

$12.50 PER Thousand for home addressing. No selling. Details for stamp. H. M. Service, Box 37215-PS, Los Angeles 37.

FREE Folio "Up to $45,000; Unlimited Vacations." No merchandise, equipment. Unknown! Work home—sparetime! Haylings—S16, Carlsbad, Calif.

SOMETHING NEW! Mailorder Information Clearinghouse. Free Prospectus. Write: Wilshire, 1324 Wilshire, Los Angeles 17P.

MAILMAN brings us $150 Daily. Operating Information for profitable mail order Business. Write Publicity, Box 727B, Kalamazoo, Michigan.

FREE Book "505 Odd Successful Businesses." Work Home! Expect something Odd! Pacific-35C, Oceanside, Calif.

$1,000 MONTHLY possible raising earthworms! Backyard, garage, basement. Complete illustrated booklet explains raising, feeding, packing, marketing. 25c postpaid! Ozark Worm Farm-V, Willow Springs, Mo.

$35 WEEKLY addressing envelopes. Instructions $1, refundable. Adservice, Spring Valley 36, New York.

HOMEWORKERS Wanted Painting Novelties. Good Earnings. N. Roland, R.R. #1, Vincentown, New Jersey.

MAKE Money with your typewriter. Details 25c. Write Barnett, 4033 Verona, Cleveland 21, Ohio.

BUY Wholesale! Save 66-2/3%! Appliances, Furniture, Jewelry, Toys, Sporting Goods, Tools. Free Catalogs. National Buyers Service, Box 426FB, Oakland, Calif.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00 you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The October issue closes on August 26. Write today for order blank. O. K. Kelly, Classified Adv. Mgr., Dept. 85, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

COMMERCIAL Formulas—catalog 10c. George, Chemist, 5150 Wilton Pl., Los Angeles 62, Calif.

LARGE Formula Catalog Free. Analysis Reasonable. Western Chemical, Salem, Oregon.

ANYTHING analized, Cosmetics, waxes, solutions, detergents, etc. Laboratories, 1706 West Lake, Chicago.

MODERN formulas for today's fastest selling big-profit products. Literature free! Miller, Chemist, 1517-A, Tampa, Florida.

ONE Formula and Catalog $1.00. Milici-PS, Chemist 1709 W. 7th Street, Los Angeles 17, California.

40 PLASTICS

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D-2-H, Portland 13, Oregon.

LAMINATING Supplies Price List Free. Solomson, 46A Cornhill, Boston 8, Mass.

PLEXIGLAS—Cut to size—Clear—Any thickness — Colors — Rods — Tubing. McClarin Plastics, P. O. Box 168 B, Hanover, Pa.

PLEXIGLAS, Lucite, Square foot cost 1/16"—$1.15, ⅛"—$1.52, 3/16"—$1.86, ¼"—$2.21, ⅜"—$3.25, ½"—$4.38. Colors add 10%. Send 15% for postage. Aristocrat Plastics, 55 Clarkson Street, New York City.

PLEXIGLAS, Fiberglas, Polyester, Acetate, Vinylite. Fast service. Wholesale-retail. Catalog—15c. Gem-O'-Lite, Box 6862P, North Hollywood, California.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00 you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The October issue closes on August 26. Write today for order blank. O. K. Kelly, Classified Adv. Mgr., Dept. 85, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

41 CHEMISTRY & PHYSICS

NEW ideas chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biologicals, and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124B West 23rd St., New York, N.Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

AMAZING New Book of Science, Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. PS-8, 2204 W. North Ave., Chicago 47, Illinois.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

CHEMISTRY, Biology, Microscopy Catalog, 25c. Laboratory Sales, Box 161-B, Brighton, Massachusetts.

EXPERIMENTERS Supplies catalog: 20c. Hagenow Laboratories, 2414 Clarks, Manitowoc, Wisconsin.

42 HELP WANTED

OVERSEAS, Latin American, Alaska, Canada Employment. Originator 1955 "Foreign Service Directory" Up-To-Minute Report on Military & Civilian Construction; Oil Companies; Aviation; Transportation; Steamship; Mining; Government Job Info. How-When-Where to apply. Listing Firms Hiring. $1.00. Global Reports, Box 683-S, Hollywood 28, Calif.

FOREIGN Employment. Construction Work. If interested in foreign projects with high pay, write Foreign Service Bureau, (Dept. P.S.), Metuchen, New Jersey.

EARN To $1500 Monthly. Many jobs available. South America, Europe, Africa, USA, etc. All Trades. Engineers, Mechanics, Office Workers, Labor, Truck Drivers, Carpenters, Electricians, Plumbers, Supervisors, etc. Many benefits. Chance to travel. Fare paid by employer. No Employment Fees. Application Forms. For free information and a quick reply Write Dept. 76D, National Employment Information, 1020 Broad, Newark, New Jersey.

LOS ANGELES & Hollywood. Jobs! Airmailed immediately, $1.00. Mowbray, Box 1113, Ventura, California.

HIGH Paying Overseas Jobs Available to men, women—trades or clerical to $1500 monthly—fares paid—openings over world. Listings, applications mailed promptly for $1.00 service fee. Send to: Better-Jobs, Dept. 48-K, 1612 S. Clinton Street, Chicago 16, Illinois

WANT Overseas Job? With high pay, Bonus, Transportation paid. Then get our Overseas Guide. With information on Foreign Countries, Income Tax, age limits, hours, overtime, etc. With actual advertisements of Construction, Oil and Mining Companies wanting men now. Rush $1.00. Airmail $1.25. Overseas Guide, Box 14, Dept. 105, Palmer, Texas.

WASHINGTON Help Wanted Columns Airmailed $1.00. Schwager, 6893 Allentown Road, Washington 22, D.C.

AT Last! Midget Presto Fire Extinguisher snuffs out fires in 3 seconds. Dramatic demonstration. Quick sales to homes, businesses, factories, farms, car owners, camps, everybody. Men making up to $1000 a month. Write, Merlite, 114 E. 32nd, Dept. 118C, New York 16.

START mail order business in your own home. We supply catalogues, circulars etc., ship orders under your name (no stock to carry) and show you exactly what to do. Postcard brings complete details, instructions absolutely free. Topval Corp., Lindenhurst 126, New York.

EARN To $1200 Monthly. Foreign and domestic job openings. Full information of all contractors. Including name, address, wage rates. Both U.S.A. and foreign. Working hours, living conditions with complete information on how to apply. Truck drivers, laborers, mechanics, pipe fitters, plasterers, electricians, clerks, etc. Get application blank by return mail. All for only $1.00, air mail $1.25. Money back guarantee. Overseas Job Bulletin, Dept. PS-6, P. O. Box 17667, Dallas, Texas.

SAN DIEGO or Los Angeles Complete Classified Section Airmailed 90c. Letters Remailed San Diego 25c. Scenic Cards 10c Each. Valley Service, 7060 Friars Road, San Diego 10, California.

THE Growing Carolinas—Charlotte's largest Help Wanted, Business Opportunity Columns Air Mailed. $1.00. Box 372, Belmont, North Carolina.

43 AGENTS WANTED

YOUR own business—Suits $1.50; Overcoats 65c; Mackinaws 35c; Shoes 12½c; Ladies' Coats 30c; Dresses 15c. Enormous profits. Catalog Free. Moro, 1218-J South Jefferson, Chicago 7.

60% PROFIT On Cosmetics—Famous nationally advertised Hollywood Cosmetics pay 60%! Make $25 day up! Hire others. For free samples, details, write Studio Girl, Glendale, Calif. Dept. PS-85.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E North Clark, Chicago.

GOLD or Silver letters, numbers. Windows, Doors, Trucks. 1" to 6". 500% Profits—Free Samples. Atlas-U, 544 West 79th, Chicago 20.

START Your Own Business On Credit. Your own boss. 1135 of our Dealers sold $5,000 to $30,000 in 1954. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant profitable business backed by world-wide industry. Write Rawleigh's, Dept. H-U-PSC, Freeport, Illinois.

NEW Plastic mending tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 73 Akron, Ohio.

ABSOLUTELY Free—Sales Kit. Increase your income. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, tie clasps, choice 3000 different emblems. Hook-Fast, Box 1425PS, Providence, R.I.

30,000,000 WOMEN want amazing new Automatic Refrigerator Defroster. You sell 8 out of 10 on sure-fire Free Trial. $250.00 weekly profit not uncommon. Rush postcard for guaranteed plan. D-Frost-O-Matic, Dept. H-103, 173 W. Madison St., Chicago 2, Illinois.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 850 N. Dearborn, Dept. 18, Chicago, Illinois.

HAVE Your own business, buy wholesale, make big profits. Free General Mdse. Catalog. Jay Norris, Dept. PS, 445 Broome St., New York.

GOOD Man Can make $3,000.00 next 90 days. Every house in town wants amazing NiLite glowing curbside house numbers. Automatic selling plan pays profits everyday. Write today for details Free. NiLite, 173 W. Madison, Dept. L-81, Chicago.

BUY Wholesale thousands nationally advertised products at big discounts. Free "Wholesale Plan." American Buyers', Hertel Station, Buffalo 16-L1, N. Y.

BEAUTIFUL Feather Pictures. 200% Profit! Free sample. Apartado 9036, Mexico 1, D. F.

MAKE More Money showing Elmira Greeting Cards this Christmas! Why more? Because Elmira offers more variety; beautiful cards for every taste, every purse. You get heart-warming, old-fashioned favorites and smartly simple ones for today's tastes. No matter who you sell, Elmira has a style to please everybody from Grandmother to young Mrs. Executive! Send today for Free personalized samples, catalog and sparkling assortments on approval with personalized stationery, imprinted napkins and lovely gift wrappings! Elmira Greeting Card Co., Elmira 203, New York.

BIGGER Profits selling Greeting Cards. Get list of sensational Factory Surplus Bargains. $1.25 boxes for 50c, $1 boxes for 35c—while they last! Big line new 1955 Christmas Cards, Stationery, Gifts. Assortments on approval, Personalized Samples Free! Midwest Cards, 1113 Washington, Dept. 566-C, St. Louis 1, Mo.

AMAZING Tall-Glow, Kodachrome Christmas Cards sell swiftly. Free Samples. $52.50 profit on 50 boxes easy! Many Cards, Stationery, Novelties. Profits to 100%, Gift Bonuses. Samples on approval. Hurry—get sensational Mail Minder Free. Creative, 4401 Cermak, Dept. 517-B, Chicago 23.

MAKE Extra Money—Selling $1.00 and $1.25 Christmas and All Occasion Card Assortments, "Slim" Cards, Gift Wrappings, Gifts, Gadgets. Experience unnecessary. Bonus! Free Imprinted Christmas Card and Stationery Samples, Selling Plan, Catalog. Write for Samples on Approval. Free $1.00 Gift for Promptness. Hedenkamp, 361 Broadway, Dept. PS-29, New York.

RUN spare-time Greeting Card and Gift Shop at home. Show friends Samples of our new 1955 Christmas and All-Occasion Greeting Cards and Gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for sample on approval. Regal Greetings, Dept. 79, Ferndale, Michigan.

NEW Tall Christmas Cards pay 75c profit on $1.25 Assortment. 40 Exclusive Name-Imprints $1.25; Gift Wraps By-The-Yard; 30 for $1 Assortment; 250 new fast sellers. 5 Assortments on approval. $1.95 Gift for promptness. Cardinal, 1400 State, Dept. 80-S, Cincinnati 14.

AT LAST! Something New and Sensational in latest Tall Christmas Cards. Make Extra Money Fast! Show Satina, Velours, Metallics. Gets Easy Orders. Pays up to 100% Profit. 30 Free Samples. With Name 50 for $1.50. Big Line. Amazing Convertible Pen-Pencil, Napkins, Gifts, Stationery. Several $1.00 Boxes on Approval. Puro Greetings, 2801 Locust, Dept. 541-K St. Louis, Missouri.

150% PROFIT selling 600 Name and Address Labels at $1 retail. You keep 60c profit. Free selling kit. Bruce Box 71-T, Boston 1, Mass.

EARN $35.00 Daily! Sell Liqui-Moly, new wonder lubricant for cars, trucks, buses, tractors. Used in jet engine, atomic energy plants. Nationally advertised magazines, newspapers, radio, television. Over 3,000,000 cans sold. Territories available. Write Moly Motors, 314 Scholes Street, Brooklyn 6, N. Y.

CALENDARS, Advertising Novelties, Matches. All styles, including Religious. Varnished 12 sheet. Girls. Hundreds of Advertising Novelties, Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

TREMENDOUS profits! Every man, woman and child a customer. Suits $1.50, Pants 35c, Dresses 20c, Shoes 20c. Operate from store, home, car. Free catalog. Superior, 1250-B, Jefferson, Chicago 7.

SELL Sunshine cards, the name Quality has made famous. No investment or experience necessary. 21 Card DeLuxe Tall Slim Assortment Sells on Sight! Imprints, Currier-Ives, Religious, Gift Wraps, many others. Samples on approval, write: Sunshine Art Studios, Inc., Dept. PS-8, Springfield 1, Massachusetts—Pasadena 1, California. (Note: East of Rockies address Springfield office.)

EARN $30. A day Showing Our Famous Boots. Part or Full Time. No experience necessary. Write for Free Sales Outfit. No Obligation. Jim Richards Shoe Co., Dept. PS8, Wellesley Hills, Mass.

CHRISTMAS Cards—Unique gallery of personalized greetings for those who want something different. No other line like it. Selection of 132 exclusive designs, including 36 especially for business firms, all with customer's name. Wide price range. Up to $5 to $75 commission on each sale. Full or part time. For elaborate sample outfit from famous old-established firm, write Process Corp., 1950 S. Troy, Dept. FC, Chicago 23, Ill.

GET New Shirt Outfit Free: make $90.00 weekly on 5 average orders a day. Famous quality Made-To-Measure dress and sport shirts at $3.95 up sell fast to all men. No experience needed. Full or part time. Write: Packard Shirt Company, Dept. 136, Terre Haute, Indiana.

EIGHT terrific agent's sellers. Free literature. Manufactured by Nicholson Products, 3407 Cahuenga, Hollywood 28, California.

HUB Cap Locks Stop Theft of Wheel Covers, Prevent Pranksters from Deflating Tires. $2.49 Set-4, 2-Keys. Key Kap Company, 739 South Main, Dayton, Ohio. COD, Check, Money Order.

EASY handwork makes fast-selling articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

WILL you wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to $30.00 in a day even in spare time, without canvassing. J. C. Field, Harrison and Throop Sts., Dept. F-1826, Chicago 7, Illinois.

WANTED: Men interested in making up to $15,000 a year. Exclusive line of personalized articles. No investment. Free information and sales kit. Write Hook-Fast, Box 480 (PS) Roanoke, Virginia.

MAKE Money Introducing World's cutest children's dresses. Big selection, adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. F-3341 Cincinnati 25, Ohio.

BIG Money making opportunity. Exclusive line work uniforms, jackets, pants, shirts, coveralls. Advertising embroidered. Every business prospect. Outfit Free. Master Div., 561 Water, Ligonier, Indiana.

USED and new watches. $2.00 up. Free list. Southern Watches, Gray, Georgia.

SHINE Shoes Without "Polish". New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee, 74, Akron, Ohio.

$15.20 AN Hour is what W. F. Wydallis reports he earns with amazing Presto Fire Extinguisher. Sells itself. No experience needed. Free sales kit. Merlite Industries, 114 E. 32nd St., Dept. 118A, New York 16.

179 EASY ways to make extra money! Sell new Tall Style Christmas, All Occasion greeting card assortments. Unusual novelties. Make up to $1.00 per box plus bonus. Write for Feature boxes on approval, 77 free samples Personal Christmas Cards, Stationery. New England Art Publishers, North Abington 833-M, Massachusetts.

CALIFORNIA sweet smelling beads, sensational sellers. Particulars free. Mission, 2328P West Pico, Los Angeles 6, Calif.

NEW Way to make money! Sell nothing yourself. Just offer free item to women for every two they sell for you. Household wares needed in every home. Postcard brings catalogue and details of amazing new kind of money-making plan. Absolutely no obligation. Topval Corp., Lindenhurst 10, New York.

MAKE-Ur-Own Aluminum Awnings. Saves 50%. Sales Kit—Free. Smith Agency-PS, Excelsior Springs, Missouri.

$43.90 PROFIT On 2 Sales Daily! Desperately needed item, untapped market 39,000,000 businessmen. Todd checkwriter, ½ price nearest competitor. 30-second demonstration. Free kit. Merlite, Dept. 10HB, 114 E. 32, New York 16.

MAKE Big Profits Selling Our New and Different Christmas Cards. Wade Greetings, 437 Harvey, Greenville, Mississippi.

EARN $30 A Day! Sell Dab-It, amazing pocket-size, stick-form, "no ring" spot remover. Works like magic! Guaranteed! M & M, S-3, 342 Third Avenue, New York 22.

EARN $200 a Week & Up! Amazing profits are yours selling Seal-Tite, miracle puncture-proofing discovery! $1.98 tube stops flats forever. Sure-fire appeal to America's 50,000,000 motorists! Complete sales kit Free on request. M & M, S-2, 342 Third Avenue, New York 22.

WE put you into big mail order business, drop shipping orders, no investment, no minimum. Catalogues supplied. Terrific new sellers, tremendous profits. Turner Company, 1170 Broadway, New York 1, New York.

BIG money! Buy Wholesale, sell Retail. Dresses, children's wear, family apparel. Lowest factory prices. No stock to carry. No sample to buy. Big Sales Kit with actual fabrics Free. C. E. Israel, Dept. F-3704, Cincinnati 25, Ohio.

FREE book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-38C, Oceanside, Calif.

SPRAY—Can fire extinguisher. Sell $2.00 you make $1.50. Eleven other profitable pressurized spray can products. Amazing sellers, repeaters. Free literature. Strobel Aerosol Co., 2412-K, Market, Louisville, Ky.

MAKE Extra Money. Sell front door name plates to friends, neighbors. Retail $1.95—you make $1.00! Free selling kit. Modern Engraving Co., P.O. Box 194, Boston 14, Mass.

GOLDMINE Of 600 money-makers. Copy Free. Specialty Salesman Magazine, Desk 6, 307 N. Michigan, Chicago 1.

A Postcard Can Put You In a Fine Business! Complete line. Leather jackets, 160 shoe styles. Big commissions. No experience, no investment. Send postcard for Free outfit. Mason Shoe, Dept. MO84, Chippewa Falls, Wisconsin.

BUY Wholesale! 100,000 Name Brand Products! Save 66-2/3%! Big profits selling others spare time! Free Catalogs. National Buyers Service, Box 426PE, Oakland, California.

MEN—MONEY . . . Spray-A-Tint Tints Windshields . . . Gives marvelous glare-proof protection—plus new 1955 look . . . sprays on-in-jiffy. Reduces glare from sun . . . Headlights, etc. Lasts for years. Auto, truck owners buy on sight. Profits 100 per cent up. Spray-A-Tint, Dept. PS-8, Consumers Bldg., Chicago 4, Ill.

$1.00 PROFIT selling $2.95 photo enlargement offer. Allen Studio, Reigler Bldg., Little Rock, Arkansas.

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44 HIGH-GRADE SALESMEN

AMIDON Fittings used many ways. Amidon Engineering Company, Elyria 21, Ohio.

AD Matches! Sell amazing designs—10, 20, 30, 40, and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PS-68 Chicago 32, Illinois.

ADVERTISING book matches—Cash in on big demand—sell Union label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-855, 7530 Greenwood, Chicago.

MAKE up to 75c profit on each dollar! Household items needed in every home. Have others sell for you. Sell wholesale to agents. Postcard brings details absolutely free. Topval Corp., Lindenhurst 127, New York.

MANAGERS Wanted to Sell Tableware and Hire Agents. Write Box 147, Union, New Jersey.

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78 WATCH REPAIRING

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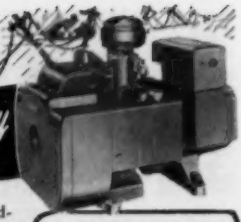

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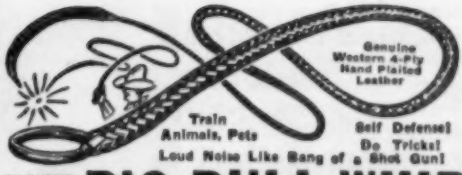

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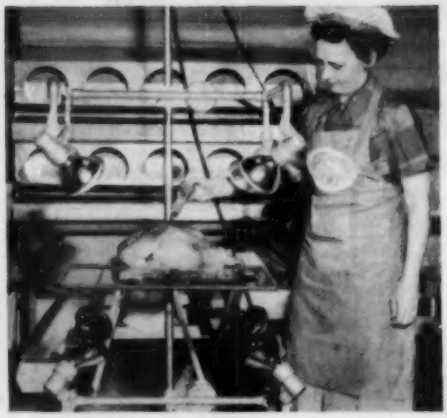
CRAFTSMEN AT WORK ...down on the farm

Two Postholes Per Minute. That's the speed of this posthole digger assembled from an automobile rear end, a plow frame and an earth-digging auger. The builder, Lester Kennedy of Deerfield, Vernon County, Mo., estimates its cost at about $40.

Light Cart Lightens Chores. This cart is a handy piece of equipment on the Charles Attig farm, near Lone Tree, Johnson County, Iowa. The location of the axle on the frame makes dumping easy.



Cooking with Glass. Roast turkey, cooked with a battery of eight infrared lamps, was a popular attraction at an open-house party at the Baxter Hatchery in Mt. Pleasant, Iowa. A local welder built the frame for the owner, Ralph Taylor.

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Wonderful Satinlac® dries so quickly, you're ready for the next coat in 3 or 4 hours. Thus, 3 coats a day is a reality! But time-saving isn't Satinlac's only advantage . . . not by a long shot! It gives you the most beautiful natural finish you've ever seen. A handsome satiny effect which not only wears well but is easy to maintain. This Wizard with Wood works like magic with hard or soft woods! Never darkens or turns yellow.

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It's the most revolutionary adhesive in years! It bonds instantly, permanently, *on contact* ...without clamps, presses or nails! It's Weldwood® Contact Cement! Bonds any combination of wood, glass, leather, paper, cloth, rubber and metal (including do-it-yourself aluminum). Makes it easy . . . even for amateurs . . . to apply Micarta or other plastic surfacing materials to table tops, kitchen counters, etc. Enables you to put up plywood paneling without nails! A real Wizard around home, shop or garage.

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We experimented for years to find a white glue worthy of Weldwood's reputation. Now we have it—Weldwood's new Presto-Set Glue. It's ready to use! Sets fast! Bonds like magic! Bonds wood to wood, wood to cloth, cloth to paper, upholstery fabrics to wood, etc. Saves you time, too, because you can often machine jobs just 30 minutes after using Presto-Set! Now available in handy "squeeze" bottle.

Best Undercoater for Plywood Stain Jobs . . . Clear Firzite!

Yes, there *is* a way to tame unsightly wild fir plywood grain! There is a way to make it take on the appearance of costlier woods. Start with a coat of Clear Firzite on stain jobs. This Wizard with Wood soaks into the pores and subdues the wavy grain; practically eliminates grain raise and surface checking. To produce oak, walnut and mahogany stains, simply add colors-in-oil.

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Professional cabinetmakers, men whose reputations are at stake on every job, call Weldwood Plastic Resin Glue, "Old Reliable" . . . and with good reason. It makes glued joints stronger than the wood itself. The joints actually grow stronger with age. It's highly water-resistant, too! More and more hobbyists have discovered that when the job *has* to be right . . . it's best to rely on the "Old Reliable" . . . Weldwood Plastic Resin Glue.

Best Undercoater for Paint Jobs . . . White Firzite!

Hobbyists use White Firzite to solve 2 distinct problems. They use it as an undercoater on fir plywood paint jobs, to seal the pores; help prevent grain raise and checking. And they use it to get a "woodsy" blond or pickled or wiped effect so popular today. White Firzite can easily be tinted with colors-in-oil to obtain any light pastel tone you want.

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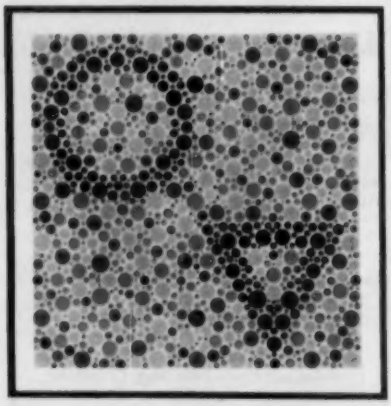
POPULAR SCIENCE MONTHLY'S • • • Last-minute news & notes

A TRIP TO EUROPE FOR $50 will be possible if a New York hotelman has his way. H.B. Cantor has plans to build two 1,250-foot superliners, each to carry 10,000 passengers and crew...HOW CAN YOU KEEP MOSQUITOES FROM PUTTING THE BITE ON YOU? Scientists of the University of Western Ontario report: Moisture increases winged attacks two to four times; light colors are less tempting than dark; green is more repellent than red or blue; olive-drab nylon cloth was the least appetizing among fabric samples tested.

ASPIRIN STOPPED KIDNEY STONES FROM FORMING, report two Massachusetts doctors. Daily doses prevented recurrence of stones or stopped the growth of existing stones in 17 out of 19 patients who had previously suffered from frequent attacks, Drs. Edwin Prien and Burnham Walker told a meeting of the American Medical Association...THERE ARE FEWER LIGHT BULBS IN THE AVERAGE AMERICAN HOME than in the average '55 car, says General Electric: 19 compared to 22.8...LOCOMOTIVE ENGINES WILL SOON BE FOUND IN OIL FIELDS. The same diesels, generators and motors used on the railroads have been adapted for use in drilling deep wells.

NEW GUIDED MISSILES HUNT DOWN THEIR TARGETS WITH HEAT WAVES. The warmth coming from isolated targets such as industrial areas, ships at sea or planes in the air cues the projectiles in...A SIMPLE TEST THAT SPOTS COLOR BLINDNESS IN SECONDS has been developed by the American Optical Company. Superimposed on a series of dots of varying shades of gray are three colored symbols formed by colored dots--circle, cross and triangle (two samples without color are shown at left)...A RADIATION DETECTOR SO TINY THAT IT WORKS THROUGH A HYPODERMIC NEEDLE has been made by Dr. D. T. Williams of Battelle Memorial Institute. Puncturing the flesh, it measures radiation in cancer treatment and in tracer experiments on living subjects.



NORTH AFRICAN ENGINEERS FIND WATER BY LOOKING FOR RUINS. How? They drill in the same places where 2,000 years ago the Romans located their wells. In one area, finding ancient oil presses, they planted olive trees.

This amazing invention can make your engine last longer without an overhaul, save you up to $250 in repairs; You never change it. This "miniature oil refinery" is

Guaranteed 100,000 Miles!

Abrasives can't get through porous bronze (greatly magnified). Because of the cone-shaped element (only the original, genuine Life-time filter has this design), particles fall to bottom of case. Only filtered oil can return to circulation in your engine.

Every mile you drive, tiny diamond-hard particles of carbon and other abrasives work their way into your oil, get between bearing and cylinder surfaces, wear out your engine.

HOW TO STOP THE DAMAGE

Now, after millions of miles of road testing in government, truck and taxi fleets as well as in hundreds of thousands of private cars, engineers announce:

"results are conclusive. Filtering oil through the Life-Time porous bronze element definitely removes 'danger zone' abrasives, prolongs engine life, reduces overhaul and repair costs."

FACTS ABOUT LIFE-TIME FILTERS

Used in supersonic aircraft as well as in cars, the *Life*-Time filter is made of millions of tiny bronze balls fused into a screen so fine it takes out *all* abrasives in the 10-to-40 micron (390-to-1500-millionths of an inch) 'danger zone' that cause major engine damage.

In addition, this "wonder metal" used during World War II and now adapted for the *Life*-Time filter actually removes acid-producing water from oil! Yet it doesn't soak up any of the valuable additives you're paying for in modern oil.

You never change a *Life*-Time filter; just rinse it out and use it over and over again. This saves you the cost of throwaway pack replacements, besides what you save on engine repairs, save on oil consumption and gain in the resale value of your car.

TRY THIS AMAZING FILTER AT OUR RISK!

Send us the make and model of your car and we'll send you a *Life*-Time filter to try in your car. If you aren't convinced within 10 days that it will *save you twenty times its cost*, we'll refund your money without question and let you keep, without any cost, the Magnalizer acid neutralizer described below. Ordering is simple:

1. If your car already has an oil filter, send for a *Life*-Time Conversion Kit which replaces your present throwaway pack with *Life*-Time porous bronze. Price: $6.95 for all cars except Buicks with hydraulic lifters and cars with full flow systems, which are $13.95 (please send make and number of present filter, if you know it). We pay postage.
2. If your car has no oil filter, send $12.95 for complete unit, including case and element. We pay postage.
3. Or send only $2 deposit, pay C.O.D. charges on arrival.

Continental Manufacturing Corporation, Dept. FPS-8
Washington Blvd. at Motor Ave., Culver City, Calif.

FREE! ACID NEUTRALIZER $2.95 value

Made of magnesium—the "sacrifice metal" that acid attacks instead of steel—the Magnalizer acid neutralizer is yours to keep free, without obligation, whether or not you decide to keep your *Life*-Time oil filter after your 10-day free trial!

DEALERS AND DISTRIBUTORS
Write or wire to find out how you can cash in on the "invention that revolutionized the oil filter industry."

Continental Manufacturing Corporation, Dept. FPS-8
Washington Blvd. at Motor Avenue, Culver City, Calif.

Name_____

_____
Make, model, year car

_____
Present filter make (if known)

Address_____

City_____ Zone____ State____

Please ship

☐ *Life*-Time filter conversion kit **$6.95** (full flow, $13.95)

☐ Complete *Life*-Time filter, with element & housing for $12.95.

California residents 3% extra.

I enclose ☐ full price; you pay shipping
☐ $2 deposit, will pay C.O.D. charges

New draw-string carton tells you it's Genuine!

New Ford packages make it easy to spot Genuine Ford Parts!

A draw-string carton for oil filter elements . . . picture-window packages for distributor points, condensers, rotors, brushes, spark plugs . . . are designed so there can be no mistake! You get the part that's made right to fit right to last longer!

Through the "picture window" you can see that these Ford Spark Plugs are Genuine.

You can be *sure* you're getting the spark plugs that are track-tested by Ford engineers to be sure they're right before being okayed for manufacture.

Genuine Ford Oil Filter Elements, safeguard your car's engine with an extra-large, super-fine filtering element. The draw-string carton safeguards you!

Genuine Ford Distributor Points, in new see-through package, are of just the same high-quality materials as *originally* in your Ford.

Genuine Ford Condenser, exactly suited to fit your Ford's particular ignition needs!

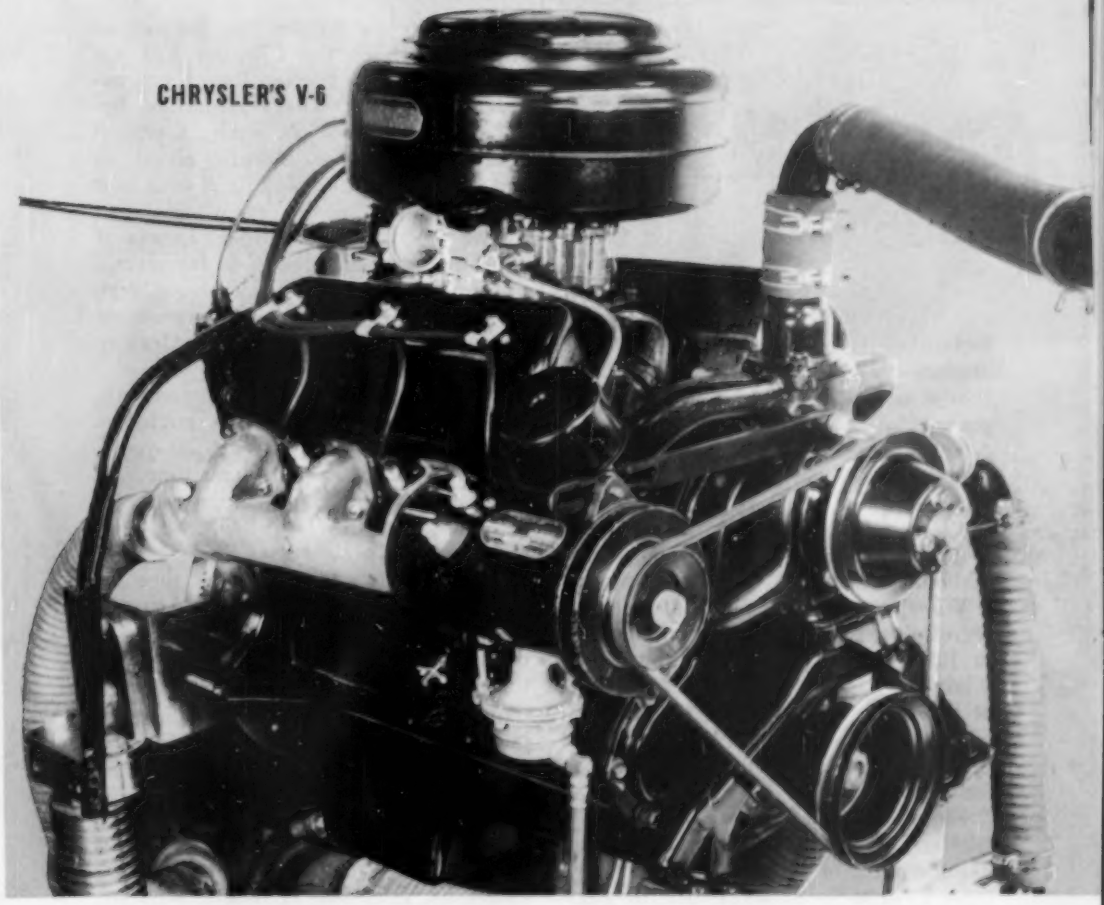
Now it's even easier to

GENUINE Ford PARTS

KEEP YOUR FORD ALL FORD

POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

Will Detroit Build V-6 Cars?



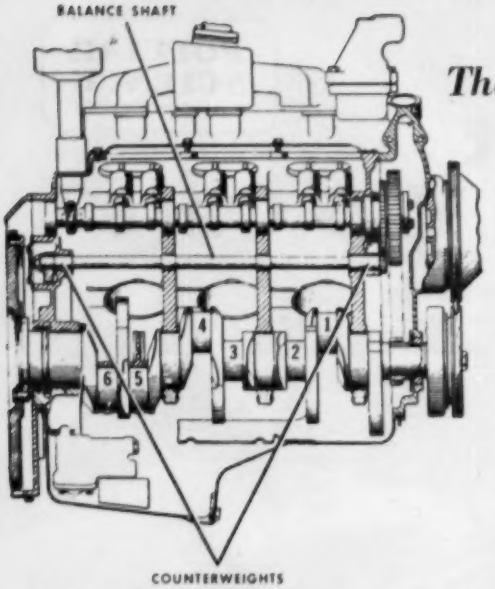
This sawed-off engine—light and economical—is practically ready for production. Nobody's saying where it goes from here.

By Devon Francis

PROMINENT among the exhibits in a General Motors show last spring were two cars placarded as being powered with six-cylinder engines arranged in a V—the genuine article, a V-6.

But the engines were not shown, nor were the cars driven in public, and GM clamped a blackout on discussion of the subject.

The Ford Motor Company, too, has



The V-6 looks good in the lab,

GENERAL MOTORS' V-6 uses same balancing shaft and crankpin arrangement (numbered on drawing) as Chrysler's. Horsepowers probably average about three-fourths of those in current, standard Plymouth and Chevvy V-8s.

forbidden its engineers to mention V-6 engines—in a way that raises suspicion that something is cooking inside the experimental labs.

The Chrysler Corporation recently completed 10 years of work on V-6 engines. It has a successful engine. Alone of the Big Three, Chrysler seems willing to talk about its V-6. But its engineers add enigmatically, "We put it in storage."

What's going on here? Is Detroit secretly getting ready to put out V-6 cars in 1956? Has somebody stumbled onto a better engine at lower cost? Is the V-6, at long last, an answer to the problem of more horsepower with less weight?

A look at the V-6 shows why it is so intriguing.

The V-6 is compact. Like the V-8, it takes up less fore-and-aft space than an in-line engine of equal power. Chrysler's turned out to be so short that the engineers had a hard time finding room on it for such accessories as the distributor and carburetor. Short engines make better visibility possible and leave more room within a car's framework for passengers.

In power-to-weight ratio, the V-6 compares very well with a V-8. Chrysler's V-6 crankshaft weighs about half as much as that of a straight six. Other components are lighter, too. Because of its short stroke, the Chrysler V-6 has considerably less friction than a comparable in-line six. That's important because, up to about 50 m.p.h., a typical present-day engine absorbs about as much power just turning itself over as it expends in driving the rear wheels.

The V-6 is no newcomer. Lancia of Italy has manufactured V-6s for several years. They're good. They placed first, second and third in the big sports-car class in the 1953 running of the Mexican road race.

The idea of a V-6 has been toyed with, hit-and-miss, by automobile engineers in this country for at least 30 years. Buick fiddled with it at one time. An interesting V-6 was built independently in Detroit in the late 1920s but was never put into production.

The industry's tepid interest thus far in the V-6 is hard to explain. The engine is no maverick. It's no mystery. It required no heroic technological breakthrough to make it successful. But it *did* require some devoted attention to iron out vibration problems that—granted—went somewhat beyond those that were encountered in engines of more conventional design.

Engines with cylinders in line, like sixes put out by Studebaker, Rambler, Chevrolet, Ford and Plymouth, have inherently good balance. V-8s require special balancing, but the problem isn't quite as complicated as in a V-6.

Why balance? To get at the nub of the V-6 problem, and how Detroit solved it, let's first see why *any* reciprocating engine has to be balanced.

All manner of weird things happen inside an engine in the process of transforming up-and-down motion of the pis-

performs well on the road

LANCIA'S V-6, the only production engine of its type, develops 90 hp. at 4,700 r.p.m. It weighs 330 pounds, has a bore of 2.83 inches, a stroke of 3.32. In photo below, it powers a Lancia with a special Farina body.

tons to flywheel rotary motion. In the shoptalk of the engineers, such motion gives rise to two important components of vibration, called primary and secondary. The primary force comes from the necessity for the piston to keep up with the crankshaft as it turns. The secondary force comes from the disturbance of this motion by the connecting rod as it speeds up and slows down the piston.

The sum of these vibrations is like that of an air hammer as it breaks up paving.

The forces involved are colossal. If a Chrysler V-8 engine, as an example, were turned at 5,000 r.p.m., it would require 3,640 pounds of force to bring each piston assembly – weighing only 2.22 pounds—to rest at the top of its stroke.

Deceleration fast. To keep the piston from going out the top of the engine, it's necessary to decelerate it at a rate of nearly eight miles per second *per second*.

Six-thousandths of a second after the piston has been stopped at top dead center, the force involved reverses itself and tries to push the engine through the floor. If the engine weren't restrained, it would walk all over the place, bouncing as it went.

To bring the piston to rest at the bottom of the stroke would require less force—2,070 pounds. The difference lies in a peculiarity: at one end of the stroke, the secondary vibrations add to the primary ones, and at the other they subtract.

Make them oppose. The best way to eliminate these forces is to make one piston oppose another, so that the forces cancel each other. Four cylinders balance out satisfactorily. The front half of the crankshaft is made a mirror image of the rear half. Pistons 1 and 4, at the ends of the crankshaft, come to top center at the same time. So do pistons 2 and 3, in the center of the shaft.

The primary forces balance. The secondary forces in this instance do not cancel out, but manufacturers of four-cylinder engines just ignore them.

With six cylinders in line (or multiples like a V-12), the balance is essentially perfect. With other types of engines, such as the V-8, a particular angle between the banks must be selected so that the forces in each bank may help to balance out each other, like those in a window and a sash weight.

This goes for V-6s, too.

There are as many types of V-6s as there are fleas on a dog. They have been made with three-throw and six-throw crankshafts, and with bank angles of 60 degrees, 90 degrees and 180 degrees.

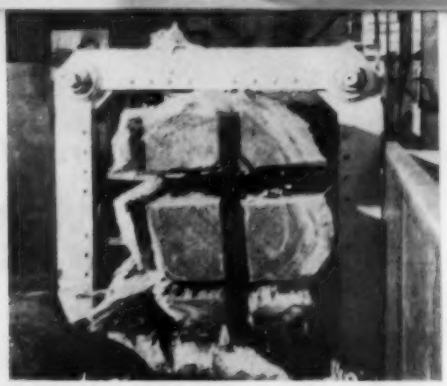
Only the six-throw crankshaft and a bank angle of 60 degrees seem to show real promise.

The crankshaft of this engine is arranged so that each bank has its pistons attached to crankpins 120 degrees apart. This causes the forces from the pistons to cancel each other at any instant.

But a piston at the rear end may be near the top of its stroke when a piston

[*Continued on page 242*]

Molded plastic buckets swing into the blue from this Sky-Master to ease the job of stringing telephone wires. The lineman operates the rotating mast and hydraulic beam from controls in the Celanese resin bucket, which is insulated against shock.

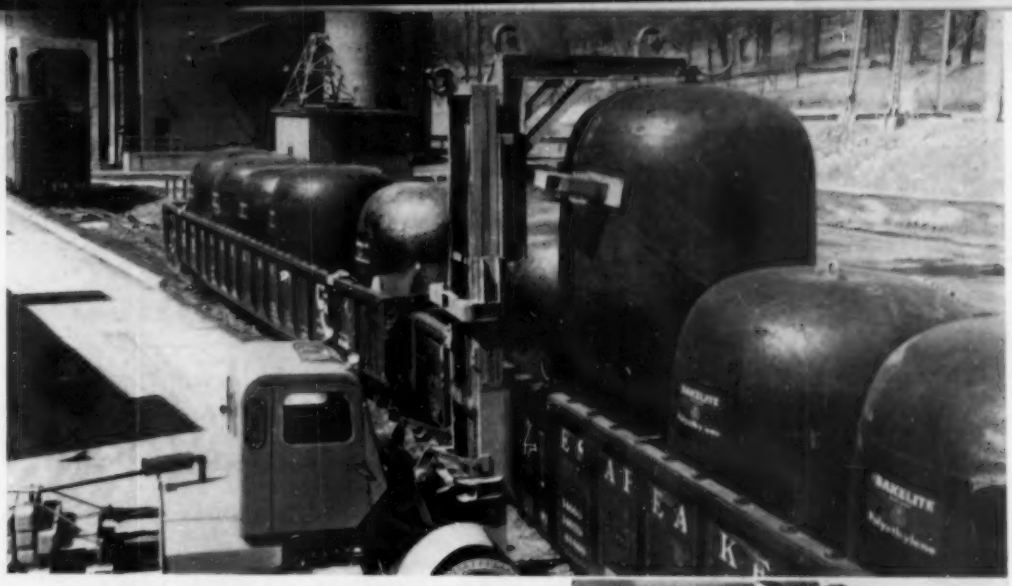


Huge stationary knives split logs up to 42 inches in diameter in the Pacific Northwest plant of the Weyerhaeuser Timber Co. A 65-ton hydraulic ram shoves the logs through. The big slivers are then cut in a chipping machine to be made into pulp.

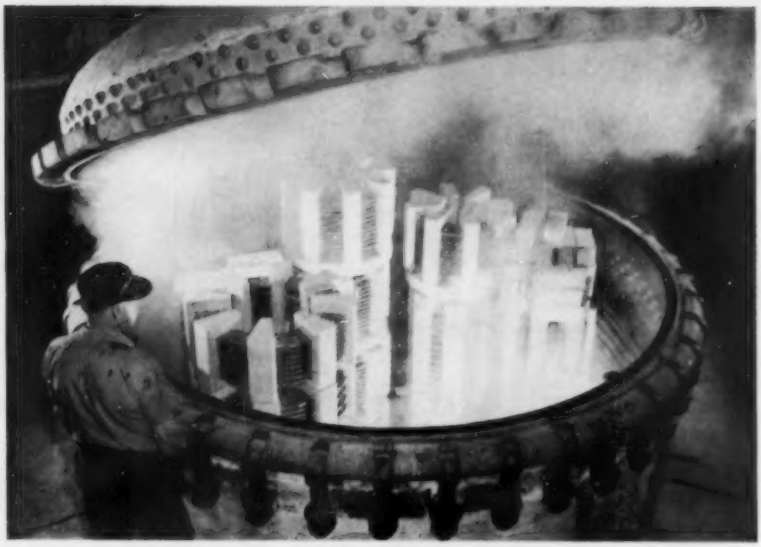
Big Machines Tackle Big Jobs

Siamese-twin leviathan, at right, made by General Motors' Euclid Division, has two 194-hp. diesel engines—one for each track—and two radiators at the rear. By reversing one engine and putting the other in forward, the driver can spin the TC-12 tractor-crawler in its own length.

Telescoping boom that functions like a giant arm to hold a variety of earth-moving tools gives this Gradall exceptional versatility. Loaded on a freight car, it's being used here to grade a railroad right-of-way. A single engine of 70 horsepower drives tandem pumps supplying oil pressure not only for boom action but also to hydraulic motors for crawler travel. Warner & Swasey, Cleveland, manufactures it.



Giant balloons swollen with almost five tons of cargo each are shown above. Used to ship raw plastic and other dry chemicals, they're made of synthetic rubber and fabric—like four-ply tires—to resist puncture, high pressures, grease, sunlight and moisture. Tests now under way by U.S. Rubber may prove the collapsible containers tops for shipping dry food in bulk. A special handling rig prevents contamination as they're filled and emptied. Bakelite says seven of the containers can be lifted from a railroad car in a half-hour. It takes 16 man-hours to unload plastic in paper bags.



Mammoth pressure cooker that works like the one in your kitchen, except that temperatures are higher and pressures many times greater, cooks concrete supports for current-limiting reactors. The wet-curing process, which was developed by GE engineers, works faster and produces stronger concrete than ordinary curing. The big reactors that absorb the jolting shocks of short circuits at electrical plants will be mounted on the concrete supports.

Kansas Mine Becomes

Trains unload inside this new cold locker that will hold as much as 2,000 refrigerator cars.

By George H. Waltz Jr. PHOTOS BY HUBERT LUCKETT

THE frozen pork chops your wife bought today at the supermarket may have spent a part of their recent past in a vast new underground food freezer inside a Kansas hill. It's called "the world's biggest icebox" by the men who have just converted part of a limestone mine on

7-Acre Food Freezer

the outskirts of Kansas City into a seven-acre subterranean cold-storage warehouse.

Frozen foods are now being shipped there from all corners of the country to be stored here at sub-zero temperatures. As needed, the food then is rushed off to market. Rapid delivery to any part of the U.S. is possible because the big underground freezer is located at just about the exact geographical center of the country. A dozen major railroads and half a dozen highways run right near it.

A while back it occurred to Leonard Strauss, the owner,

UNDERGROUND RAILROAD SIDING allows refrigerator cars to be unloaded inside the plant. Lift trucks move foods to cold-storage rooms.

FROZEN FOOD'S TEMPERATURE is spot-checked as it is unloaded from refrigerator cars. This can, from a carton that rode on car's floor, showed a temperature of seven degrees below zero.

250-TON REFRIGERATING SYSTEM keeps the eight big freezer rooms at minus 10 degrees and the eight cooler rooms at just the right temperature for whatever is being stored.

SUB-SURFACE QUARRY that houses underground deep freeze is still being mined at a rate of 3,000 tons of limestone a day. Mined-out portion provides 105 acres of usable space.

that, in the mine's 20-year lifetime, his miners had created a huge one-story underground building carved out of solid rock. Such a building would cost millions to build aboveground. Furthermore, it was dry and, because it was underground, it had a constant year-round temperature—a low 55 degrees Fahrenheit.

Cooler inside. Strauss reasoned that it would be far easier to refrigerate a portion of this sprawling underground building than it would be to cool an aboveground warehouse exposed to the sun.

The remainder of the mine—about 105 acres of a possible 400 have already been mined out—would make an ideal place for storing such things as tires, chemicals and tools that should be kept cool and dry but not refrigerated.

Strauss formed the Inland Cold Storage Company and went to work. The first step, completed just before the accompanying photos were taken, was construction of the underground freezer. Built into seven acres of the mine, it consists of eight large sub-zero freezer rooms and eight smaller cooler rooms for storing such things as beer, flowers and fruits that don't need to be kept frozen.

Storage space aplenty. All told, there are 3,000,000 cubic feet of cold-storage space. That's enough to store the contents of more than 2,000 refrigerated railroad cars.

There are no frost-covered freezing coils in this giant "icebox." Frigid brine, cooled down by a 250-ton refrigeration system, is circulated to king-size air conditioners in each room. These units cool, dry and circulate the air.

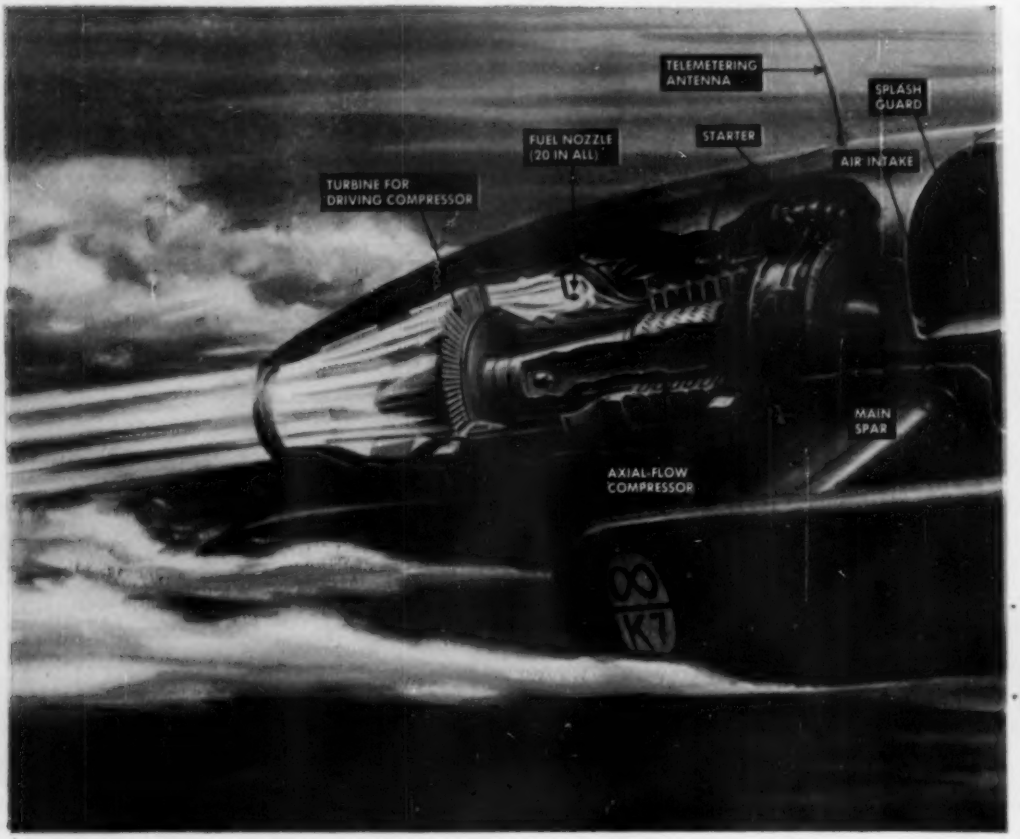
Insulation is provided by hundreds of feet of solid rock bolstered here and there with an inner lining of foam-glass blocks. If the power should fail, the temperature in the cold rooms would climb no more than three degrees in 60 days. A similar emergency in most conventional cold-storage warehouses would cause a rise in temperature of about five degrees every day.

INSULATED SLIDING DOORS separate cooler and freezer rooms. To eliminate possibility of cave-ins, the natural limestone ceiling is anchored to rock above by 13-foot roof bolts.

TRUCKS AND TRAINS bring food to and from the big underground cold-storage plant. Six major trucking highways and 12 railroads run close to the freezer's front door. END

Lazing along at a part-throttle 160 m.p.h., the Bluebird behaved fine on its first trials.

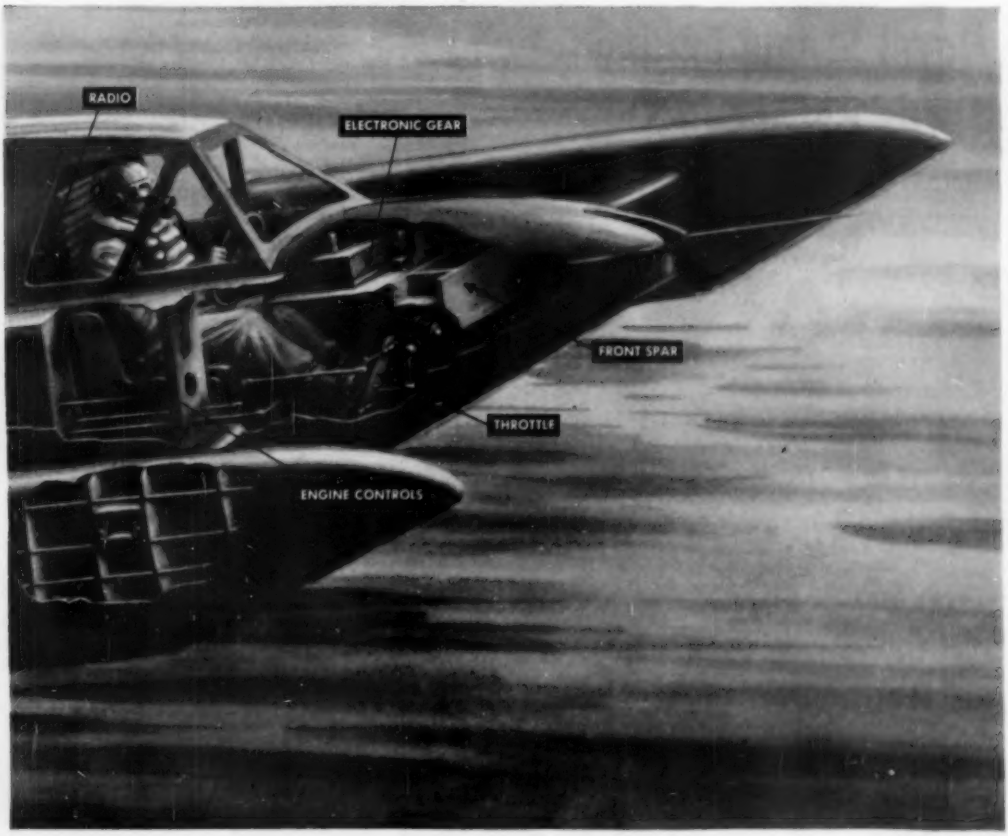
Jet-Driven Speedboat Built Twice as Tough as Fighter

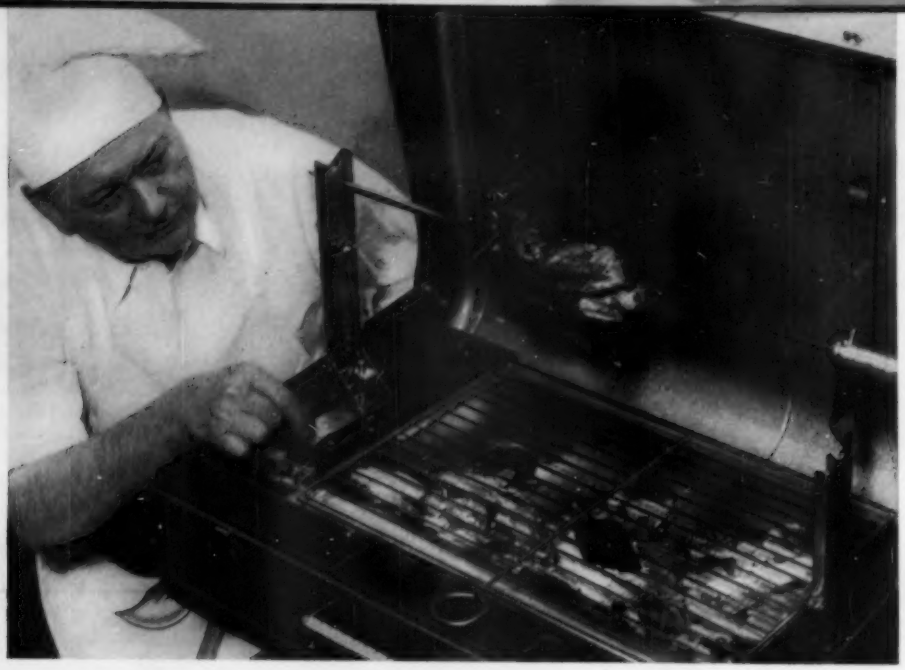


SPEEDS near 200 m.p.h. are wickedly dangerous afloat because of the peril of uncontrollable pitching. This can quickly build up to a point where the craft flips tail over teakettle and disintegrates. To lick this "oscillation barrier," Britain's Donald Campbell (son of the late Sir Malcolm) has used every trick in the book in building the jet speedboat pictured here. Initial designs were carefully modified after wind-tunnel and towing-tank experiments. Then a big model was built and tested under radio control at speeds of around 90 m.p.h. Finally, a boat-to-shore telemetering system was built into the *Bluebird*. The instant it detects the start of dangerous oscillations it buzzes a warning in Campbell's ear.

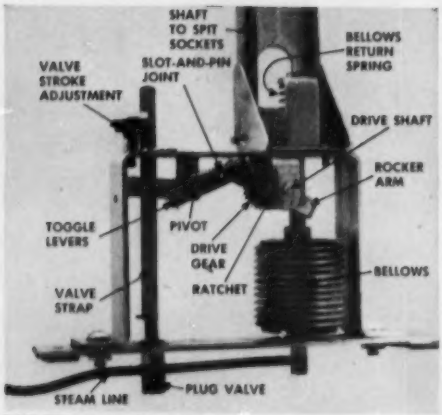
The $70,000 *Bluebird* weighs 2½ tons, has a jet engine of 4,000-pound thrust, and is built of high-strength steel to a safety factor more than twice that of supersonic jet planes. Campbell plans an assault on the official 178-m.p.h. world's record, now U.S.-held, and on the unofficial 207-m.p.h. mark hit by John Cobb's boat just before it disintegrated.

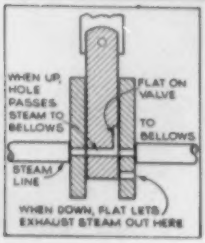
SEAT on which Campbell is standing has quick-release in case a disaster overtakes the boat.





Novel Steam Engine Turns Barbecue Spit





ENGINE ROOM. Capable of running at a fast dog-pant, this unusual engine easily turns a spit at roasting speed. Toggle action operates the valve almost 180 degrees behind bellows stroke. A spring returns the bellows and valve during the exhaust stroke.

YOU can get away from it all—including electric lines—and still cook a rotisserie meal with this self-powered spit, turned by a pistonless steam engine.

It has a boiler . . . Lying along the front of the firebox is a horizontal tank. Water is poured into a swing-up funnel that automatically closes the filler opening when turned down. Burning charcoal is drawn up alongside the boiler, generating steam. If pressure becomes excessive, a simple safety valve blows off.

. . . but no cylinder or piston. Instead of a piston working in a cylinder, the engine has a sealed bellows, like an auto cooling-system thermostat. The valve is a plug working in a sleeve.

No flywheel either . . . The up-and-down motion of the bellows works a rocker arm on the drive shaft. Through a ratchet, this turns the shaft a little at each stroke in one direction only. This intermittent rotary motion is transmitted through bevel gears to the spit.

The outer end of the rocker arm trips a toggle lever that moves the valve up and down. By turning an adjustable stop, the amount of valve movement, and so the speed, can be controlled. Buch Mfg. Co., of Elizabethtown, Pa., makes it.

1945 1955

In Year 10 of the Atomic Age

Consider the Available Facts

"BY SPLITTING the atom," POPULAR SCIENCE MONTHLY reported hopefully 10 years ago, "man may have united the world."

What has happened since then? Some of the outstanding events of the first atomic decade are reviewed in the next 10 pages of this issue.

Instead of one bomb, there is now a great variety of atomic weapons. Stockpiles of fissionable material await detonation or controlled, constructive consumption. The available facts indicate clearly that war now would be far more horrible than ever before. But available facts also indicate that blessings barely dreamed of 10 years ago will ensue if war can be avoided.

More is known now about the radiation which is emitted when atoms are split than was known in 1945. Radiation, as well as the heat from bursting atoms, can be utilized; and it can be used as wisely and safely as fire or electricity. But more remains to be learned about it. Exposure to radiation may harm not only persons now living but also those who have not yet been born. How seriously? The experts are not certain. But the danger that any child will be born in any home at any time with a handicap that might have been prevented is one that no Christian can disregard. Hence, atomic developments still trouble the consciences of men of good will—because of their own uncertainties and other men's hostility.

No one can review developments since the first atomic bomb burst over Hiroshima without hoping devoutly that ways will be found—despite the difficulties that the newspapers remind you of every day—to unite the world and make certain that peace will prevail. We hope that you will read the next few pages slowly and thoughtfully.

The Editors

1945 1955

Atomic Milestones Since Hiroshima

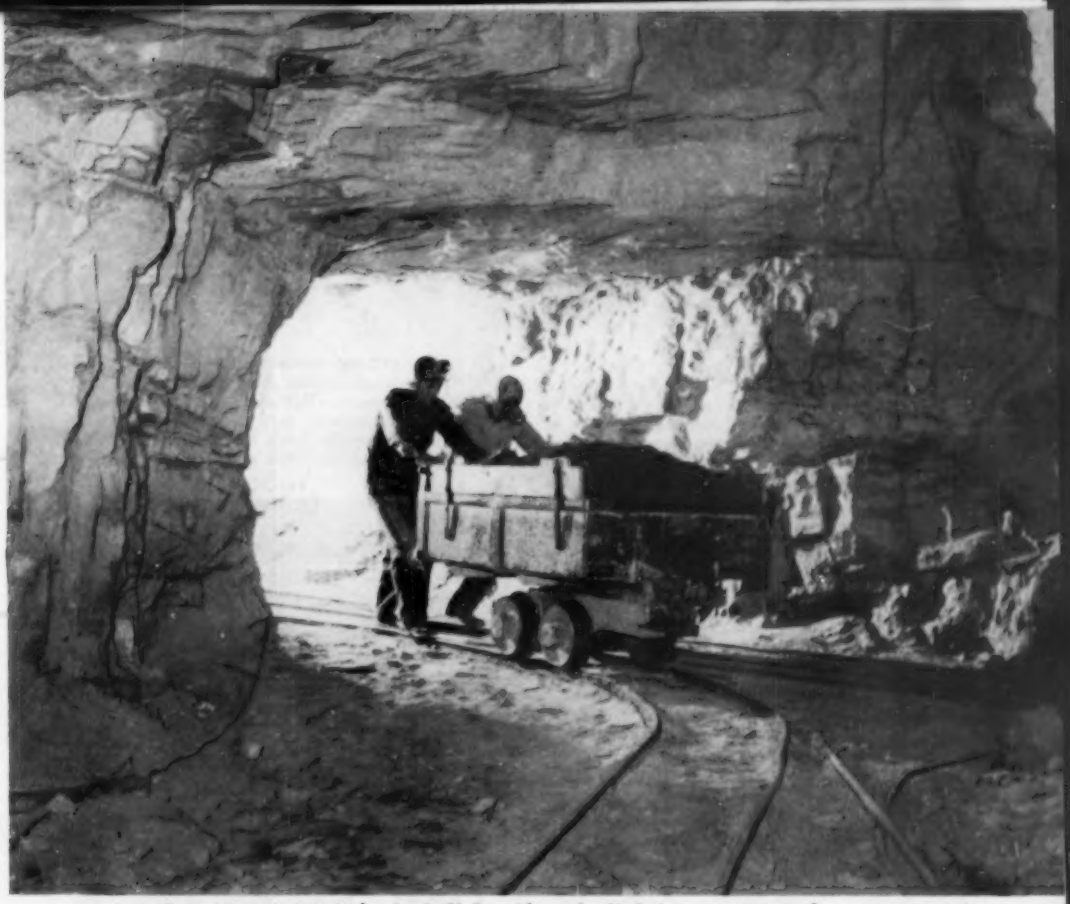
Photographs tell the dramatic story of 10 years of progress in harnessing the mighty atom.

JUST 10 years ago—on August 6, 1945, at Hiroshima, Japan—the first A-bomb to be dropped in war announced to the world the dawn of the Atomic Age. Highlights of the momentous developments that have followed are reviewed here in pictures.

Radioisotopes have conferred the boon of healing, and of advancing man's quest for knowledge. The H-bomb's scarlet fire has brought the power to destroy on a fantastic scale. Yoking the atom to whirring electric generators promises miracles for constructive ends. Ready to do whichever may be man's bidding, as another decade begins, is the mighty atomic genie he has summoned up.

1946 **RADIOISOTOPES** made in Oak Ridge pile inaugurate wide use of these artificial radioactive substances (left), scarce and costly before, to cure disease and serve as tracers in research. Since first shipment in 1946, total number now exceeds 50,000.

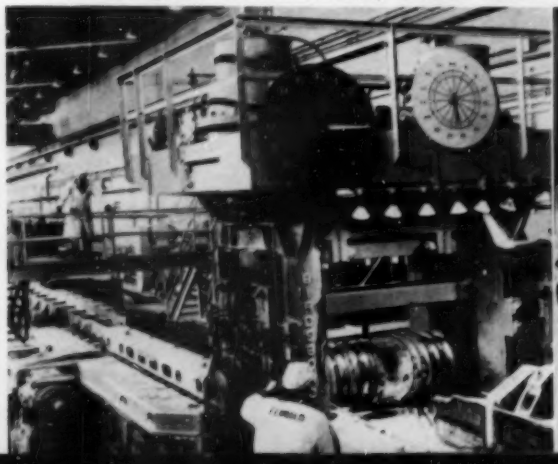
1947 **FAST REACTOR** completed at Los Alamos, first of kind, foreshadows future designs for atomic power. Small compared to bulky uranium-and-graphite predecessors, it burns plutonium, and is cooled by liquid metal instead of by water or air.

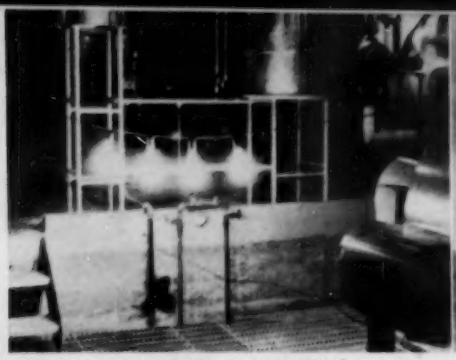


1948 **URANIUM RUSH** begins in U. S., with announcement of Government program to spur the hunt for the newly strategic metal, including generous payment for ore and a fat bonus for extra-rich finds. Within the next few years, the resulting boom sweeps the U. S. into next-to-top place among uranium-producing nations of the world—second only to the Belgian Congo, with its fabulous Shinkolobwe pitchblende mine. In small-scale and typical U. S. mine above, miners are hand-tramming their uranium ore to bin outside portal.

1949 **MAKING A-BOMBS** is revolutionized by U. S.-developed method of mass production. New technique, and news that Russia has A-bomb, speed stockpiling. Details being secret, symbolic photo shows rolling mill for raw material, uranium metal.

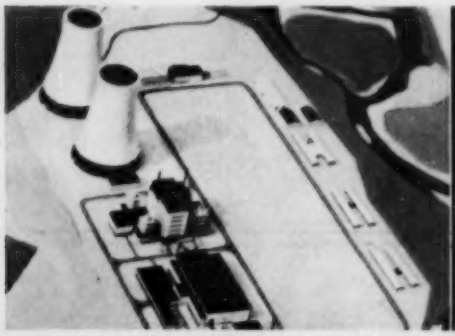
1950 **ATOMIC HOSPITALS,** the first exclusively for atomic medicine, open at Oak Ridge and Brookhaven reactor sites. Posed photo demonstrates how Geiger counter checks effect on patient of "atomic cocktail" of radioiodine from Brookhaven reactor.





1951 **FIRST ELECTRIC POWER** from atom lights building, and bulbs in photo. Token amount exceeding 100 kw. is generated by Experimental Breeder Reactor at Arco, Idaho. Later, same reactor proves "breeding" can vastly augment atomic-fuel supply.

1952 **ATOMIC CANNON** unveiled by U. S. demonstrates not only a new A-weapon—but also the wide variety of atomic ammunition now available, ranging down to size that fits gun's bore. The following year, the cannon fires the first nuclear shell.



1953 **FULL-SCALE ATOM POWER STATION** takes shape as construction begins of first in history, to generate between 50,000 and 100,000 kw., at Calder Hall, England. Model previews it. Due now for completion, it may be running this month.

1954 **H-BOMB** facts burst upon world as U. S. explodes biggest hydrogen bomb, and bares its awesome power. U. S. had set off its first (photo) in November, 1952; Russia in August, 1953. But even existence of H-bombs was secret till end of 1953.

1955 **"UNDER WAY ON ATOMIC POWER"** is historic message flashed by U. S. submarine *Nautilus*, world's first atom-propelled craft—and forerunner of others that may ply the sea and air, on peaceful as well as military missions, in the years ahead.

1945 1955

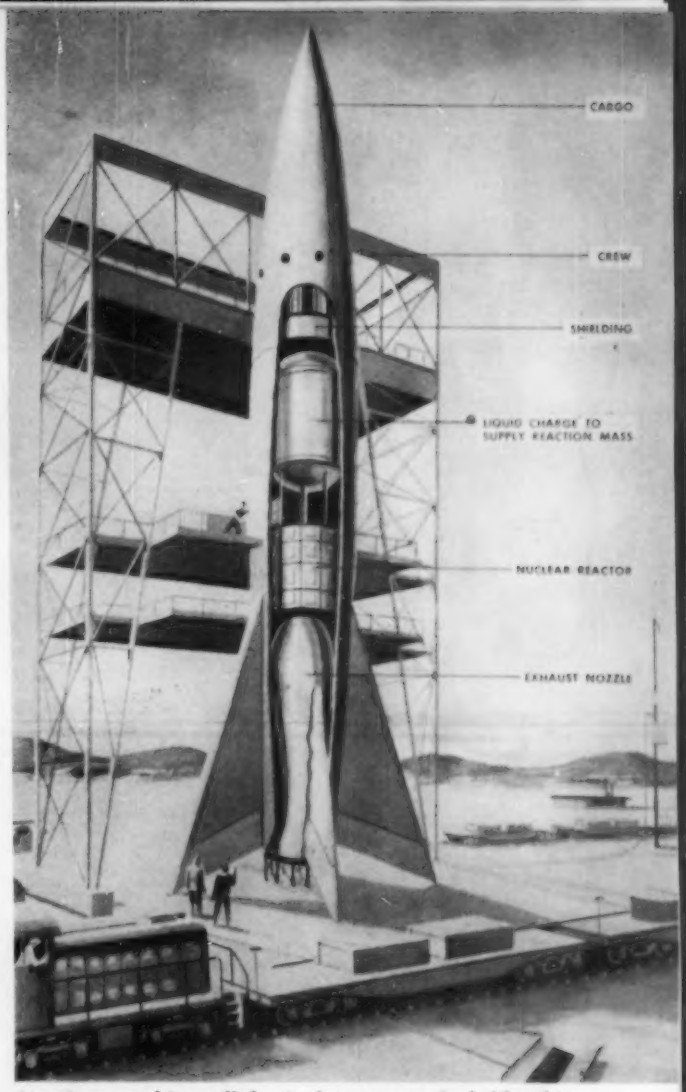
TOMORROW:

Atomic Travel

LOOKING ahead, experts foresee that we'll travel in ships like the ones pictured on this page.

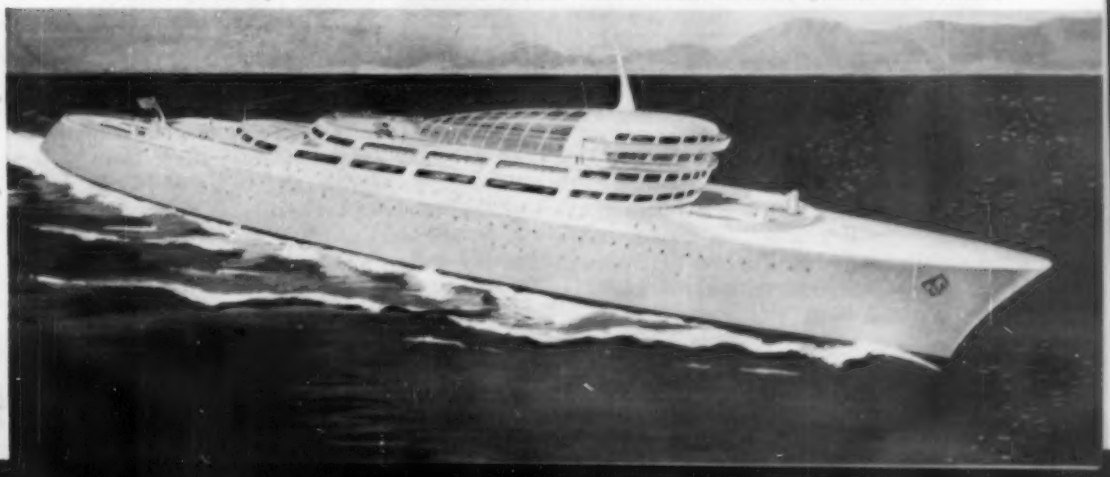
Atomic ocean liners may be near. Since last October, the Bethlehem Steel Company's shipbuilding division has been perfecting plans for the 500-passenger, 600-foot vessel illustrated below. It would have long range without refueling, and dispensing with fuel-oil tanks would make more room for cargo.

An atomic spaceship, General Electric engineers say, awaits more novel and distant developments: a reactor yielding electricity directly, and an engine shooting a jet of electrified particles rearward for propulsion. Laboratory experiments suggest that both may be possible.

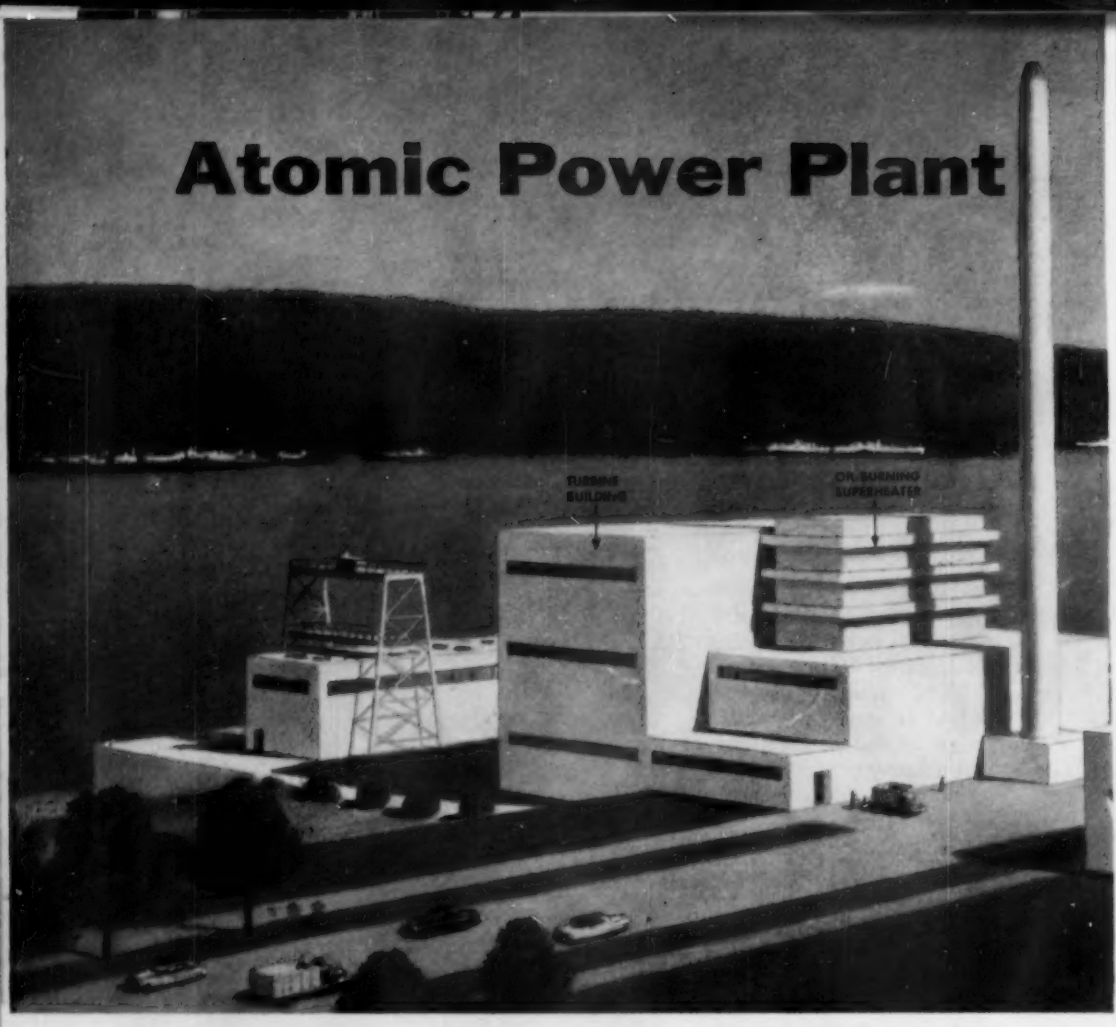


Atomic spaceship, still far in future, may look like this.

Atomic liner may come soon. Stackless reactor makes steam to drive turbines and screws.



Atomic Power Plant



By Martin Mann

NEW YORK CITY'S electric company is planning a new power plant. What's unusual is that this one will run on exploding atoms. By the end of 1959, Times Square may sparkle with atomic electricity.

From any angle Consolidated Edison's venture will be a remarkable breed of generating station.

It will be the biggest of the five U.S. atomic electric plants now proposed, with a capacity of 250,000 kilowatts. That's enough for half a million homes, and a comfortable addition to Con Ed's present capacity (from nine stations) of 3,500,000 kilowatts.

The atomic furnace will manufacture part of its own fuel by converting an element called thorium into uranium. Some of this newly made uranium will be consumed to produce power. But the plant will also use ordinary fuel oil in a standard furnace that will make the atomic steam hotter for greater efficiency.

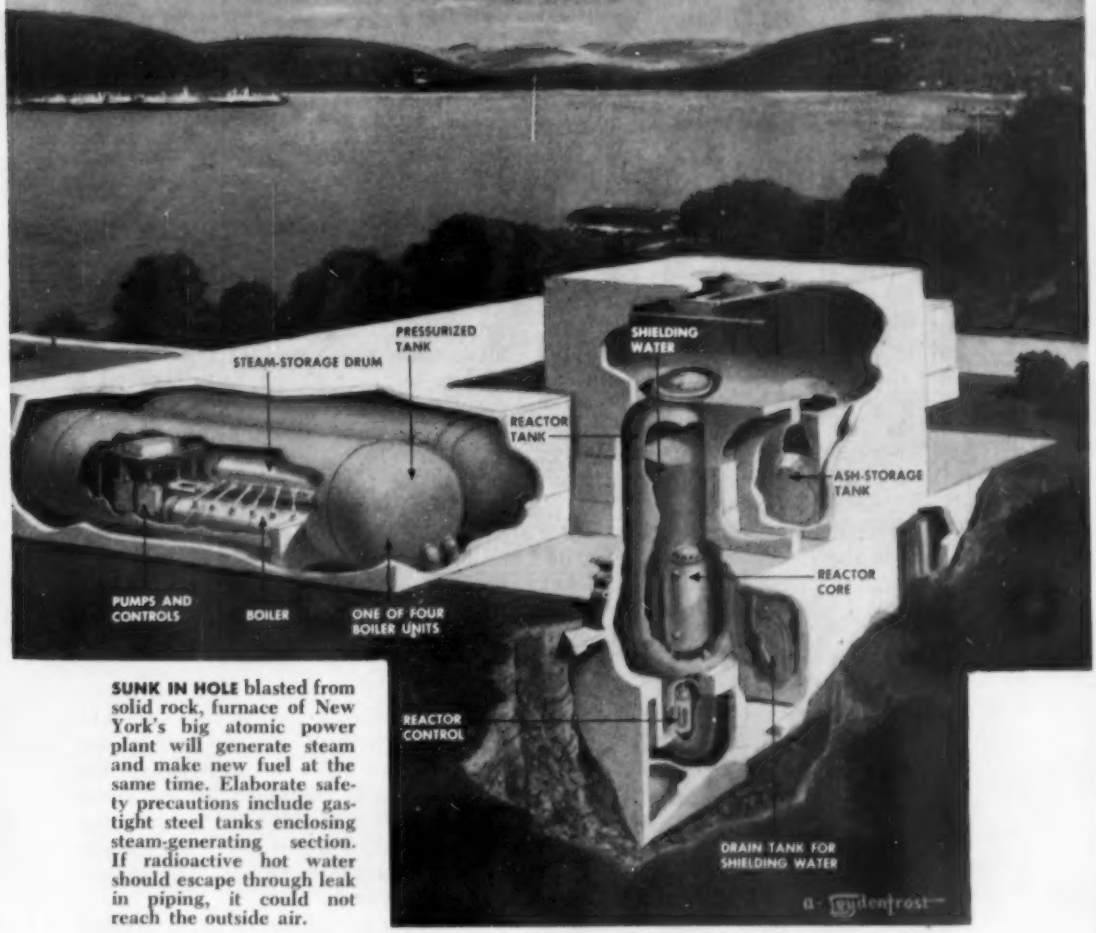
Unlike most atomic furnaces, which are located in remote areas such as Arco, Idaho, and Oak Ridge, Tenn., this one will be 24 miles up the Hudson River from the nation's biggest city, on an old picnic ground between Peekskill and Buchanan, N. Y. There are 45,000 people living within five miles, although only 16 families live as close as half a mile.

Con Ed never forgets that its business

1945 1955

to Serve New York

The country's biggest, it will burn a combination of uranium, thorium—and ordinary fuel oil—to make 250,000 kilowatts, enough for half a million homes.



SUNK IN HOLE blasted from solid rock, furnace of New York's big atomic power plant will generate steam and make new fuel at the same time. Elaborate safety precautions include gas-tight steel tanks enclosing steam-generating section. If radioactive hot water should escape through leak in piping, it could not reach the outside air.

is power, not research, and it set out to get a plant that would make electricity practically, safely and cheaply.

"We were pleasantly surprised," remarks the company's bespectacled, professorial engineering v-p, Jim Fairman, "to learn that it wouldn't be as costly as we had feared. The plant will run around $230 a kilowatt. That compares favorably with the $200 a kilowatt we would have to spend for a new conventional plant. Operating costs should be less than at some of our older stations."

Old reliable PWR. The atomic furnace Con Ed chose is a "pressurized water reactor," as tried and tested a

What it takes to generate 250,000 kilowatts for a day

Consolidated Edison's atomic power plant will use 1½ LB. URANIUM, 64 LB. THORIUM AND 10½ R. R. TANK CARS OF OIL

A conventional power plant of the same capacity would use

30 R. R. HOPPER CARS OF COAL

OR 48 R. R. TANK CARS OF OIL

model as you can buy in an industry just celebrating its tenth public anniversary. The submarine *Nautilus* uses a PWR. Many others have been built in this country and abroad.

This type of furnace has water circulating through its core to do two jobs: to slow down the atomic fragments so that they will keep the reaction going, and to remove the heat. Outside the core, the pressurized hot water turns a second water supply into steam for the turbines. The PWR almost runs itself—to a large extent it can balance the power it makes to changes in load, without changes in control settings.

Unfortunately, a PWR can't heat water as hot as the engineers would like, because higher temperatures might distort the metal fuel elements and block the water tubes. Con Ed will get steam at 449°, too cold for efficient use. Worse yet, the steam will be saturated with water vapor, which can do nasty things to the turbine blades.

OLD PICNIC GROUND, once the destination of steamboat excursions, is site for atomic power plant. Buildings will occupy only small part of the 350-acre area (outline).

If this were a coal boiler, the low-temperature saturated steam would simply be sent back into the furnace to pick up more heat. You can't do that with an atomic furnace. So Con Ed plans a separate oil-fired superheater to warm the atom-made steam to 1,000°. The superheater, burning 85,000 gallons of oil a day, will add 100,000 kilowatts to the plant's output and sharply cut cost.

Manufacturing fuel at the same time it is being burned up is another trick Con Ed counts on to make its atomic electricity economical. Thorium will be converted into uranium-233 by the nuclear reaction. This uranium-233 is valuable as fuel, of course. But it also saves money in another way, by extending the life of a single fuel charge.

With this type of atomic furnace you can't continuously feed in fuel and take out ashes, the way you can with a coal furnace. You have to shut down the atomic furnace, cautiously lift out spent fuel with long-handled tongs operating under the shielding water, then equally cautiously slip in fresh fuel. The job occupies a day or so.

By taking advantage of the converted thorium, Con Ed expects to refuel only three or four times a year. The plant will use 40 times as much thorium source material (10 tons a year) as it will uranium (500 lb. a year). However, not all the thorium will be converted into fuel, and not all that is converted can be burned.

This use of thorium marks a curious

BIGGEST ATOMIC POWER PLANT now proposed, the Consolidated Edison station will generate enough electricity to supply, by itself, all needs of a city of about 750,000 population—a city such as San Francisco, Pittsburgh or Boston. Its capacity will get a big boost from an oil-burning superheater that improves efficiency.

turn of history for Consolidated Edison. Back in the gas-lit Nineties, it was one of the country's biggest consumers of thorium—for the lamp mantles that glow incandescent when heated by a gas flame. Some New Yorkers still illuminate their homes with gas lamps, and only recently a Con Ed repair crew combed sidestreet hardware stores to find replacement mantles for one such customer.

How safe is it? Pressurized water reactors cannot blow up. In tests, they have been forced to run away (overheat), but only with great difficulty. Even then, the fuel elements simply melt and the fire goes out.

Many engineers consider the PWR "inherently safe" because it has a negative temperature coefficient—the hotter it gets, the slower it runs. Heat causes the cooling water to expand, pushing the water's hydrogen atoms farther apart. With fewer hydrogen atoms per unit volume, fewer neutrons can be slowed to the speed needed to keep the reaction going. It is this same process that makes a PWR largely self-controlling.

Despite this furnace's built-in gentleness, its designers plan to treat it like an H-bomb with a live fuse. They will surround it with control upon control, meter upon meter. Most of the controls will be entirely automatic, and only a small crew —a dozen or so men—will be needed to operate the plant.

An important section might require a complicated arrangement such as this: Three or more separate instruments watch the same point, but measure different characteristics. (The cooling water, for example, could be checked for temperature, pressure, radioactivity.) If one reading is abnormal, a red light glows—maybe the meter's wrong. If two needles say trouble, a bell rings. If all three agree on danger, klaxons howl all over the place and the automatic controls cause a "fast scram." That kills the furnace dead in a few thousandths of one second.

Emergency power arrangements—to keep the plant operating—will be impressively complex. Three independent circuits will furnish normal power, and important items like pumps are to be divided among them. If all Con Ed should go dark, a tie-line to a neighboring utility across the river or to an emergency generator could take over. Controls will run on two separate battery circuits, each charged independently.

Should all sources of power somehow fail at once, the furnace will just shut itself off. The control rods are designed to "fail safe." Without power they will fall into the furnace and stop the reaction.

Suppose the impossible catastrophe strikes—a serious runaway? Con Ed would be faced with an awesome spill, a pool of radioactive water and melted metal. This would be serious but not excessively dangerous. For the furnace will be underground, in a hole blasted out of solid rock.

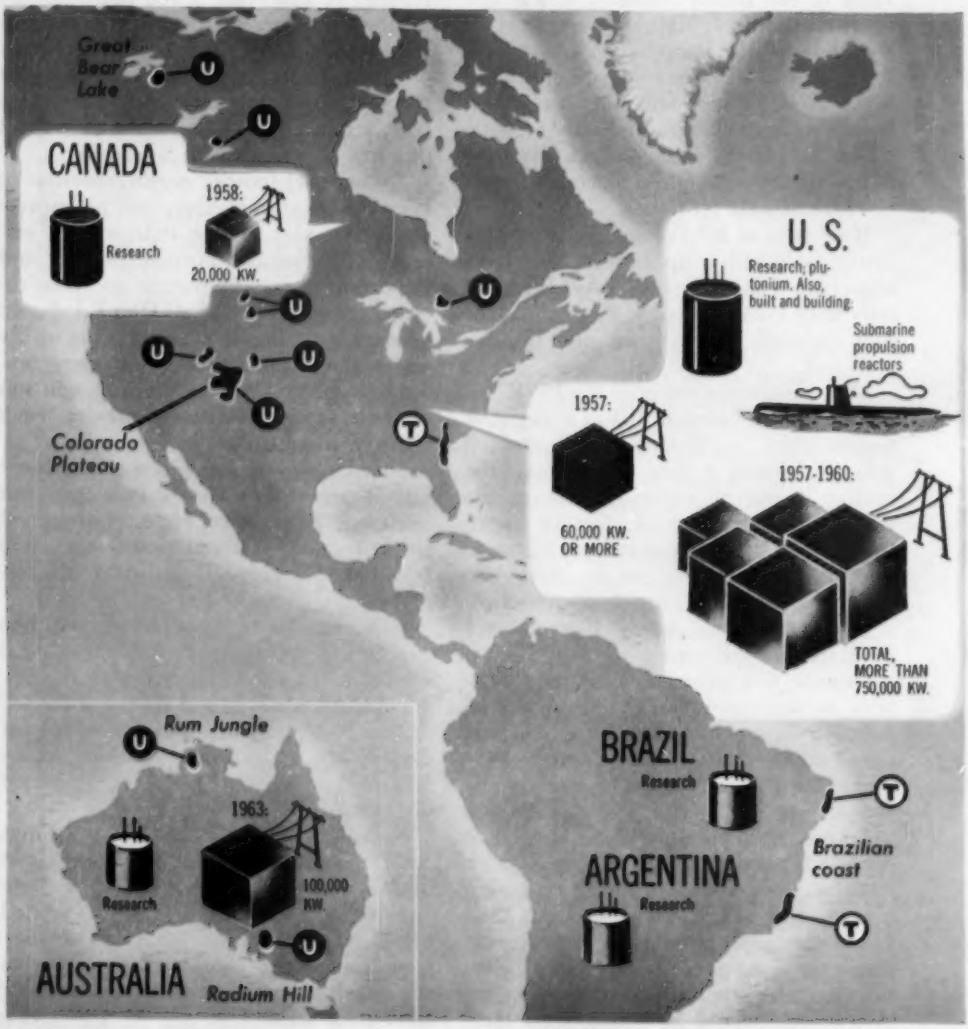
No one believes any of these things could possibly happen. They are about as likely as collapse of the Empire State Building. That they have been planned for is a measure of the extreme care Government and industry have given to the establishment of the atom as our servant of tomorrow. END

1945 1955

World's Nations Race

ALTHOUGH the U. S. plans the biggest atom-power station—the 250,000-kw. Consolidated Edison plant described on the preceding pages—the race is close for world leadership in making the atom cook breakfast, light lamps and run machines. The map below shows rival nations' announced A-power projects; and the world's principal sources of uranium and thorium, the atomic fuels.

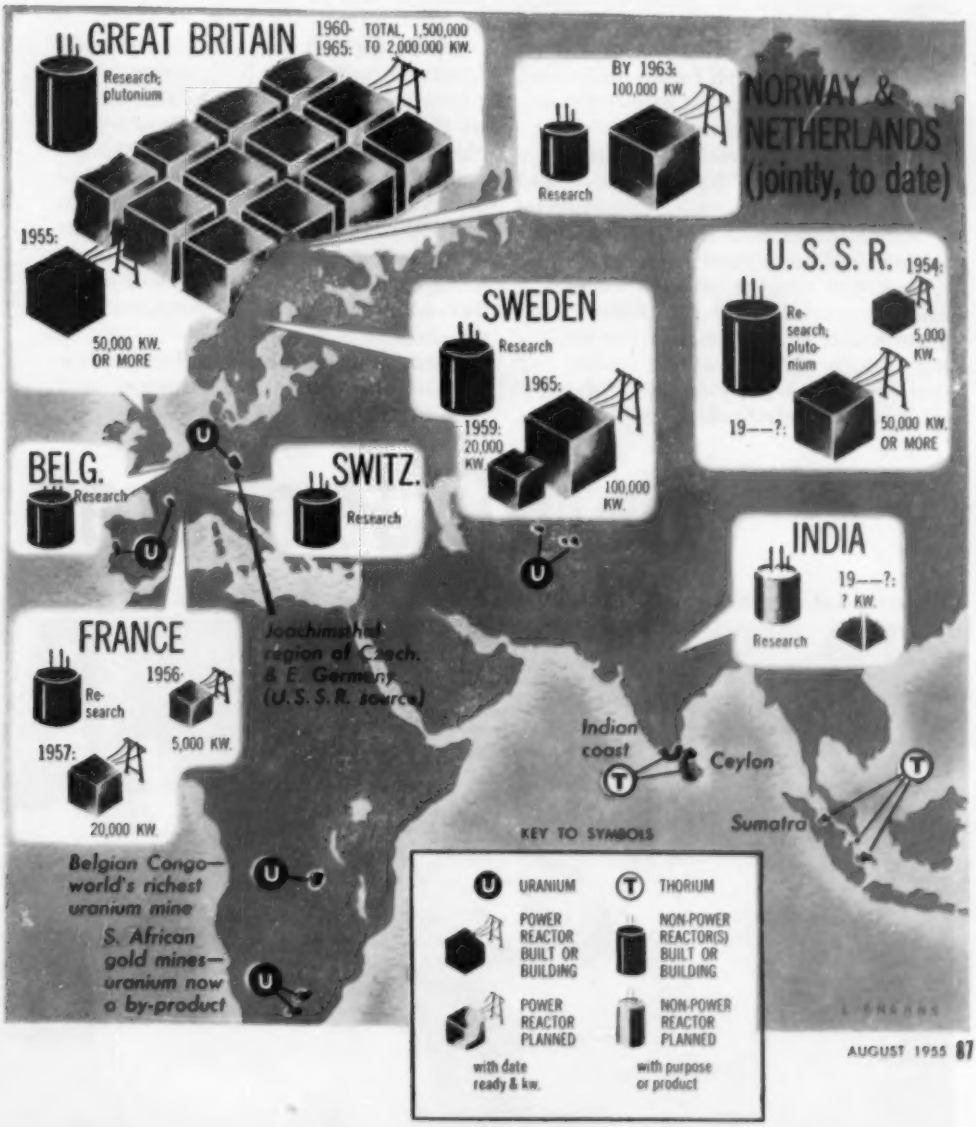
England boasts the first full-scale atomic central station—originally to be ready in 1956, but already so far advanced that its generators may be turning by the time you read this. Varying estimates have put its ultimate capacity at 50,000 to 100,000 kw. By 1965, 12 more British A-power stations will total 1,500,000 to 2,000,000 kw. Dwindling coal reserves spur the plans.



to Harness Atomic Power

In the U. S. a full-scale atom-power plant rising at Shippingport, Pa., will yield 60,000 kw. or more by 1957. A-power projects so far announced by electric companies, subject to Government approval, would exceed 750,000 kw. by 1960—and put this country out in front. Holding this possible lead, over Britain's big program, would depend upon what other U. S. projects may develop.

Russia, which last year announced an experimental-scale A-power plant of 5,000 kw. in operation, and a full-scale one of 50,000 to 100,000 kw. in prospect, vies for third place with France, Canada, Sweden and others. Nations planning their first reactors of any kind include India, poor in coal but rich in thorium, and one of the nations with most to gain from A-power.



What to expect in 1956 Cars

BEGINNING next month, hold on to your hat. Detroit will begin announcing its 1956 automobiles, and yup, horsepowers are going up—again! Styling changes will be considerable, even among the cars that were spanking new in '55. And watch for an unabashed emphasis on safety *(see report below)*.

Here's the scuttlebutt:

Buick: The "Special" model is being dressed up to give Ford, Chevvy and Plymouth a run for their money. The Dynaflow drive, with *two* variable-pitch stators, will have even more sass.

Cadillac: Biggest change will be a completely redone Hydra-Matic transmission that will eliminate those annoying upshifts and downshifts. Caddy will sport two new body styles, add wind splits on the rear fenders.

Chevrolet: While the basic body shell will remain the same, don't bank on recognizing the vehicle. Changes are major. That Ferrari-like grille will be replaced. Power will be boosted.

Chrysler: With an engine upped in cubage from 331 to 353, the New Yorker Deluxe will add some 20 horsepower for a total of 270. Chrysler's "300," now at 331 cubic inches, will shoot up probably to 364 inches.

Continental: Got $10,000? It will take almost that many skins to buy this low-slung revival of Lincoln's elegant old buggy.

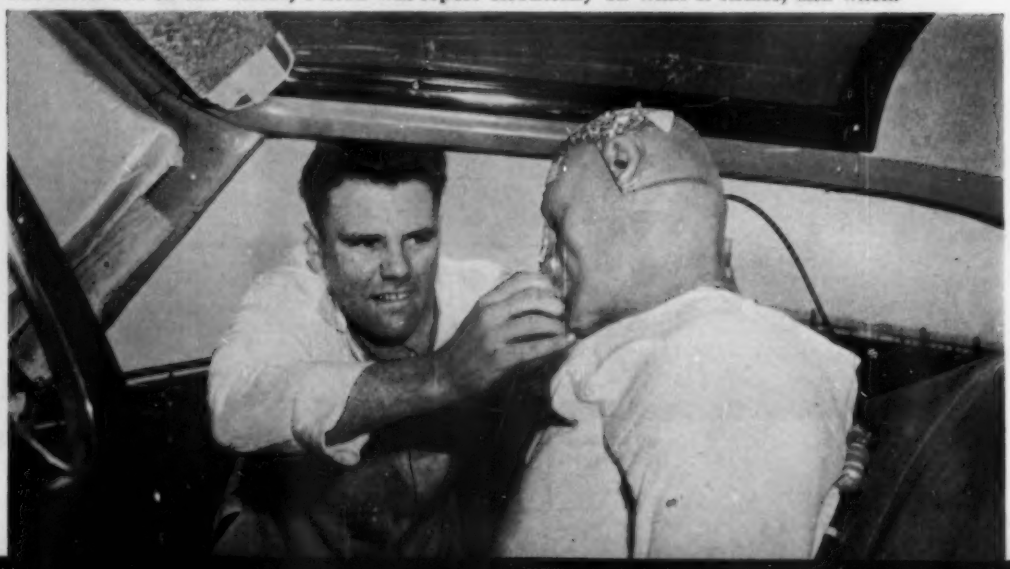
De Soto: This fine car, largely unappreciated, will raise horsepower to between 220 and 230. Like the entire Chrysler Corp. line, De Soto will have styling changes that go beyond "face lifting."

Dodge: Will undergo only a modest power increase—probably to between 205 and 210 from its present 193, but will get a bigger displacement against future horsepower demands. Dodge will retain its current body shell, but watch for radical changes in the front end.

Ford: Will fancy-up the Fairlane line to compete with Buick. Engines and power train have been refurbished. Ford,

Detroit Prepares

The metal foil on this dummy's head will report electrically on what it strikes, and when.



bit in teeth, will incorporate new safety features.

Hudson: Body changes will divorce its looks from those of Nash, companion American Motors car. Hudson possibly will be the only 1956 car to resist the blandishments of more power.

Imperial: Snootiest of the Chrysler Corp. carriages, this Palm Springs-and-Miami job will borrow its power from the New Yorker, share styling with the "300."

Lincoln: Brand-new, from chassis on through engine and body, the Lincoln will be longer, sleeker and—at long last—competitive with Chrysler, Caddy and Packard. Item: crash-safety features.

Mercury: Will undergo some change in garmenting and a handsome boost in power, especially in the Montclair line.

Nash: Rear-end sheet metal will be replaced, and power will mount.

Oldsmobile: Like Cadillac and Pontiac, Olds will have that spectacular new transmission, a more sophisticated version of the automatic that for years has been the oomphiest in existence. Some styling changes and—more horses.

Packard: The big baby will have the highest horsepower in the industry, and the gossip peddlers say "positively." The Clipper will have the highest in its price class (Mercury, Olds, Buick, etc.) Torsion-bar suspension will be drifted down to all lines.

THE 1956 CROP OF CARS is still under wraps. Popular Science Monthly will remove the shrouds for you as new models are announced.

Plymouth: The top line will approach 190 horsepower *without* the addition of a "power pack." New rear-end sheet metal, plus a new grille, will change its looks.

Pontiac: That new transmission, of course, plus a four-door hardtop. New grille. More power? Naturally.

Rambler: Look for a car that's new from headlight bezels to tailpipe. The old L-head Six is being replaced with an OHV job. The car will be bigger.

Studebaker: The change in looks, sports coupe excepted, will surprise you. Hood and deck will be raised. Commander and President lines will have new engines, higher power.

to Stress Safety

THE sickening *kar-runch!* when a swiftly moving car slams into something solid can be heard regularly these days at the Ford test track in Dearborn, Mich. The fact that a big auto maker has had a large-scale crash program going for months is real news. More important, perhaps, is the fact they admit it: "Crash" has been a dirty word in the salesrooms.

A recent analysis by a Cornell accident-study group indicated that safety has not kept pace with other advances. It showed that people riding in newer cars were no better off, in the frequency and severity of injuries, than people in older cars.

Ford's crash research shows that impacts at moderate velocities generate terrific decelerations. A car that piles into a barrier at only 30 m.p.h. may experience decelerations of almost 100 G's a foot behind the bumper. Progressive crumpling of the structure dissipates part of the kinetic energy. Seventy inches back, forces may be down to 10 or 15 G's.

About the time this issue appears, seat belts will become optional on all Ford-built cars. (Chrysler made belts an option last spring.) The crash experiments indicate that belts definitely improve your chances of survival. Other Ford crash-program findings are scheduled to be reflected in the '56 models.

Please turn the page for pictures of a crash test

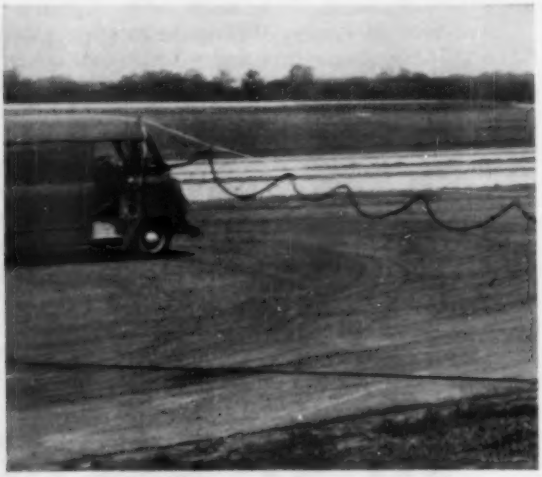
A scientific crash takes instruments and skill

SKULL-SHAPED metal weights are used in Ford lab to test dashboard materials. Steering wheels have also been a big part of recent program.

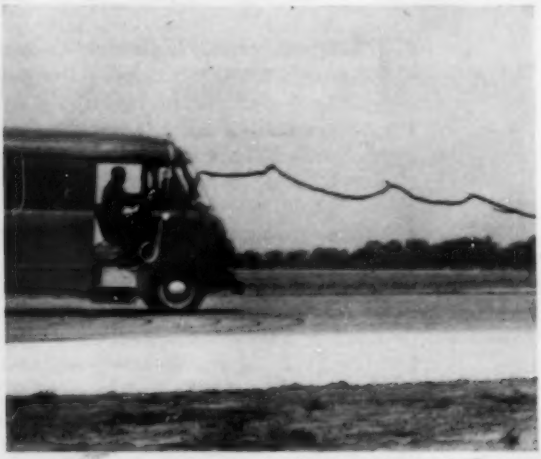
180-POUND DUMMY named Ferd (initials of Ford Engineering Research Department) is toted out. His joints can be set to simulate bracing.

ELABORATE INSTRUMENTATION in van gives a microsecond-by-microsecond record of what happens in a crash, and at what decelerations.

A final check is made of the 1954 hardtop

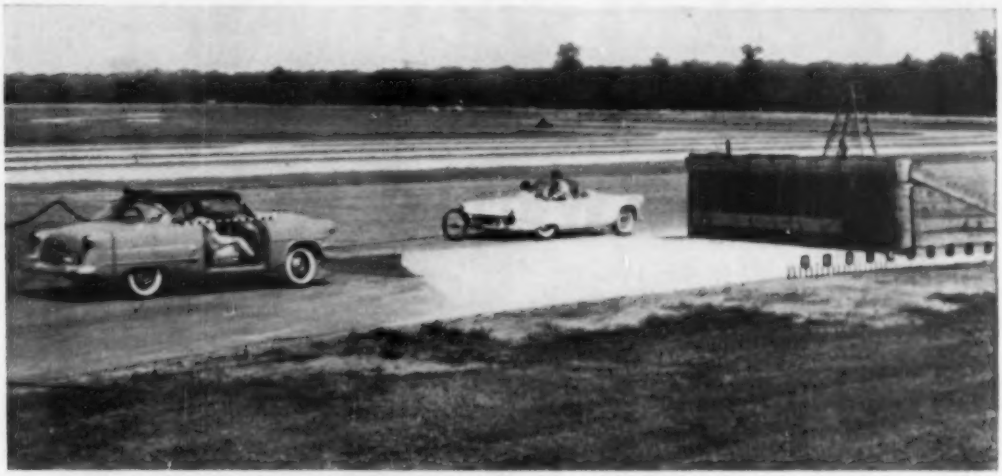


Towed by a T-Bird, car nears end of its life.

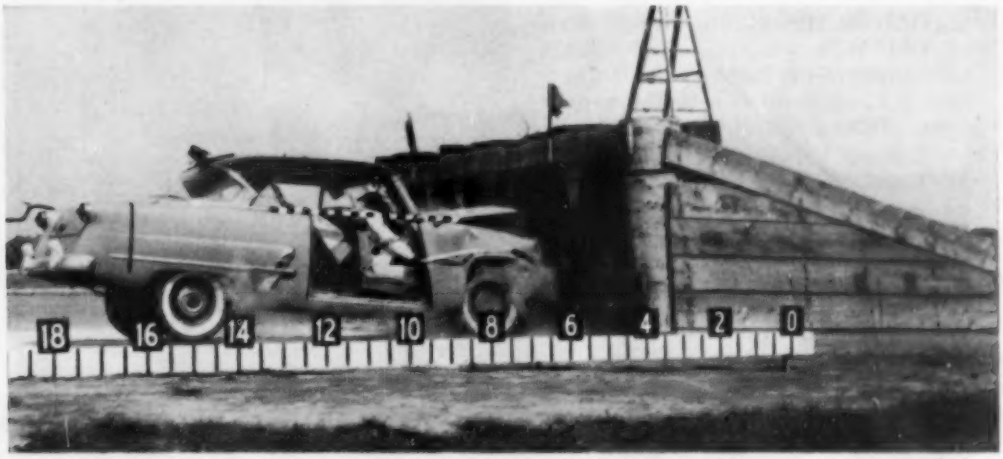


Impact! At a crash speed of only 30 m.p.h.,

(at left) to be crashed. Van will run alongside, its electronic cable supported by a shock cord.



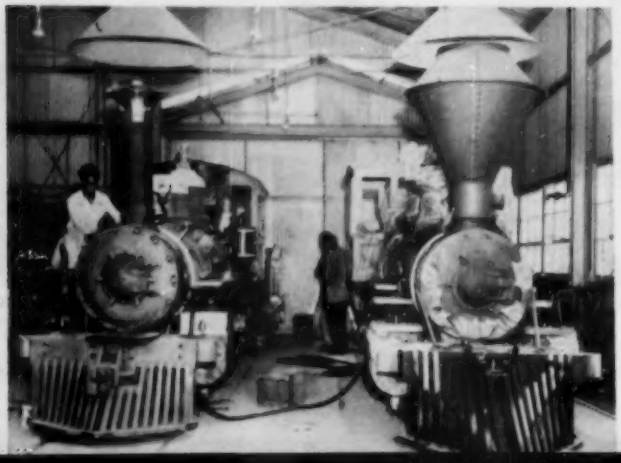
Trip latch cuts tow car free. Three movie cameras, one welded in hardtop roof, are running.



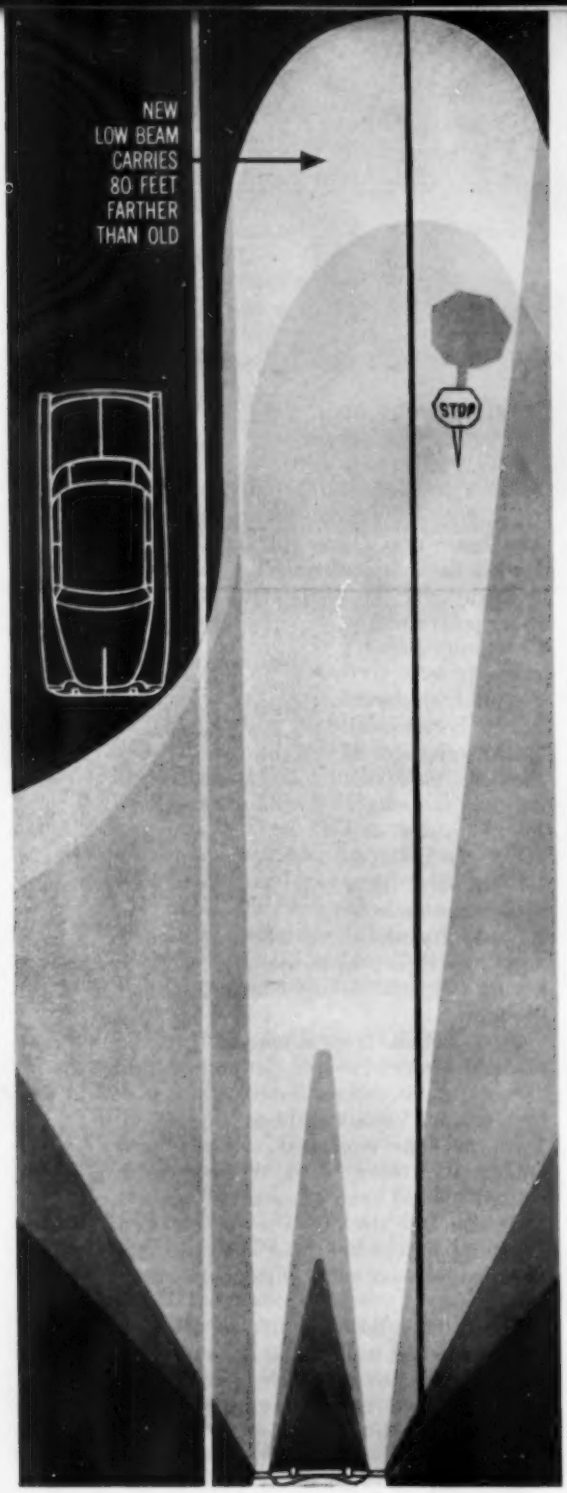
ferocious decelerations were recorded up front. G forces inside the car were much less.

Kids' Dream World Comes True

DISNEYLAND—a steel-and-concrete Never-Never Land for youngsters—has come to life at Anaheim, Calif. It's Walt Disney's fantastic kingdom dropped out of a cloud onto 160 acres. There your child can drive the car of the future, ride in a Mississippi stern-wheeler or romp through a medieval castle. If he wants a glimpse of Tomorrowland, Fantasyland, Frontierland or Main Street, U.S.A., there are two re-creations of Old West passenger and freight trains—part of the Santa Fe and Disneyland R.R.—to carry him to the various sights of Disney's real-life dream world.



OLD-WEST RAILROAD, five-eighths original size, takes passengers on the 1¼-mile ride around Disneyland. The Santa Fe and Disneyland R.R. consists of a passenger train (four coaches, observation car, baggage-mail car) and a freight train, each able to carry 200 passengers. The locomotives at left, shown being polished up before opening day, pull them. The tender above, four stockcars and a caboose make up the freight train.



Now You Can Drive Better at Night

New head lamps for all cars light road farther—without blinding the other fellow.

By Lloyd Stouffer

THERE'S a stop sign at a dark corner near my home that I always used to forget about—never sighted it until I was so close I had to stop with a protesting squeal of the tires. That's what happened until I blew a few bucks recently for a pair of those new-type head lamps. Now I see that stop sign a good half block away.

This incident is typical. Already 3,000,000 other American motorists have found that the new lamps—standard on all new cars and available everywhere as replacements for old ones—are making night driving safer and pleasanter (PSM, Dec. '54, p. 94).

Step on the high beam and you have a road ribbon of light such as you never saw before—25 percent more light illuminating 1,500 feet ahead. Shift to low beam and you'll see 80 feet farther than you could previously along that critical right side of the road, with about twice as much light.

No kickback from fog. I don't bother with fog lights. These new head lamps cut surprisingly through fog, rain, snow and dust.

And the other fellow? The brighter lights won't dazzle him if they are aimed

HEADLIGHTS GET BETTER AND BETTER

YEARS	HEAD-LAMP TYPES
1902 — 1906	Oil Lamp
1906 — 1912	Acetylene
1912 — 1915	Vacuum
1915 — 1924	Gas Filled 1st Use of Lenses
1924 — 1928	Two Filament Upper and Lower Beams
1928 — 1934	Fixed Focus
1934 — 1939	Prefocused
1939 — 1955	Sealed Beam Single Unit Hermetically Sealed, Accurately Focused
1955	Improved Sealed Beam Filament Cap Greater Seeing Distance On Lower Beam, Better Visibility in Fog, Rain, etc.

correctly and dimmed when he is 1,000 feet away. I have tested that point in repeated runs against opposing test cars. Actually, there's far less flash at the passing point.

Night driving has changed significantly since the old sealed-beam head lamp was adopted 15 years ago. The number of cars on the road has doubled in the same period, and is now up to 60 million. The average driver has had less and less opportunity to use the high beam meant for highway driving. He has bowled along at 50 and 60 on low beam, which was designed only for town driving and occasional passing. The old low beam is definitely unsafe for speeds over 35 m.p.h.—it doesn't reach far enough. That's one reason why night driving has been three times as hazardous as daytime driving, and last year killed 20,000.

More watts added. To make the new low beam a better driving light, the engineers put in five watts more power (a total of 40 watts in the low beam, 50 in the high) and raised the hot spot of the low beam one degree. They also redesigned the lens and reflector and added a shade over the filament to direct this more powerful low beam just where it's needed.

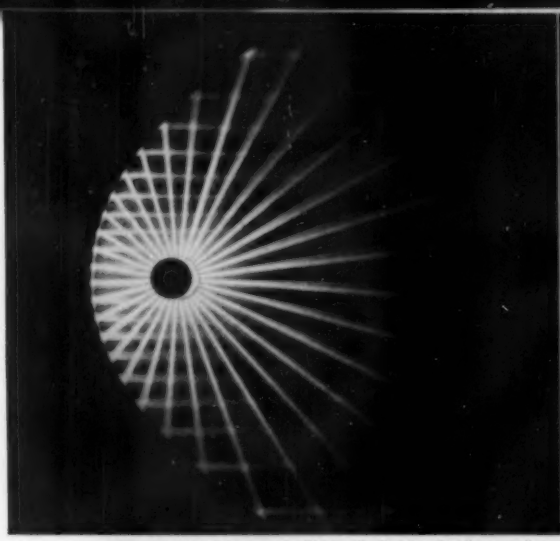
> ***This new head lamp is the greatest safety motor equipment since the adoption of hydraulic brakes.***
>
> —James A. Hoye, Director of Traffic, Detroit

The high beam has not been raised. But the changes in the lens have distributed more light to the sides and above the horizontal. The effect is to make the whole of the countryside ahead of you brighter and clearer. You have less of a sense of boring through the night behind a shaft of light.

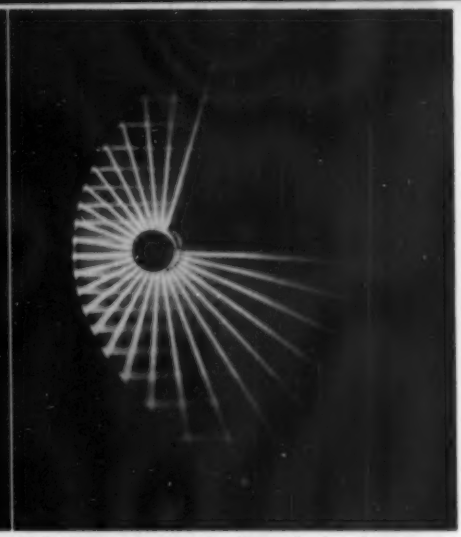
Tests show improvement. At the General Motors Proving Ground outside Detroit, night road tests showed just how far a driver's vision had been lengthened. Two cars—one equipped with the new lamps, the other with the old—were started toward each other from opposite ends of a mile stretch. They accelerated to 40 m.p.h. and held that speed so that they would pass each other at the halfway point.

Along the right-hand side of the road for each driver was posted a series of 12 test targets—each a 16-inch-square board painted a dull charcoal gray, approximately equivalent to a pedestrian in dark clothing.

Each driver pressed his horn at the



THE OLD LAMP was little help in bad weather because it let much light shine upward. Particles of fog or snow reflected up light to create a bright curtain surrounding the car.



THE NEW LAMP cuts through fog because a shield over the low-beam filament prevents direct light from shining upward to be reflected by particles in the atmosphere.

instant that he perceived a target. This placed a pip on a moving graph calibrated to show road distance. Then, as the car passed the target, an observer pressed a switch connected to the same instrument. The difference between the two marks showed how far ahead the driver had perceived the target.

With both old and new lamps visibility was markedly reduced as the cars approached and passed, because of glare from each other's lights. But the degree of improvement with the new lamp was striking.

When the cars were 4,400 feet apart, seeing distance was 310 feet with the old lamp, 370 with the new; at 1,200 feet it fell to 265 feet for the old lamp, 315 feet for the new.

The critical point came when the approaching cars were just 200 feet apart. Here the old lamp provided vision for only about 205 feet—barely up to the approaching car. The new lamp was good for 25 feet more.

At the passing point, visibility began to increase: rapidly for the new beam, more slowly for the old. About 400 feet beyond the meeting point the new beam gained a seeing distance of 420 feet, while the old lagged at 320.

This quick regaining of visibility after passing is particularly important, for the human eye is usually handicapped during those critical first seconds after the flash, until the retina has become fully readjusted. A pedestrian or an obstacle at that point is in an especially dangerous situation.

Headlight engineers draw a sharp distinction between "expected" and "unexpected" hazards. It's the unexpected that kills people. And you can spot unexpected hazards only half as far off as you can expected dangers.

One night after a sequence of routine tests the engineers directed their driver back to the laboratory. Casually, they guided him into a deserted road where a dummy pedestrian had been set up. As soon as the unsuspecting driver spotted the figure in his headlights, he jammed on the brakes and squealed to a stop.

> ***There is a marked increase in vision, especially in fog, rain and snow.***
>
> —F. N. Littlejohn, Chief of Police, Charlotte, N. C.

"Now let's go around the block," the driver was told, "and try that again. Same speed, and don't apply the brakes until you actually see the dummy." On

[*Continued on page 228*]

HOT That's how some like it, especially on chilly mornings in Milwaukee, where 50 overhead heaters warm both customers and carhops at a drive-in restaurant. The Infra Rayhead Gas Heaters, made by Perfection Industries, Inc., Cleveland, work like the sun, warming objects rather than the air, and thus conserve fuel.

COLD And some, particularly milkmen, like to keep their goods cold. That's why the Borden Company at Menands, N.Y., got this outdoor circuit-breaker rack. At end of day, drivers load up, then hitch their truck refrigerating systems to the electric rack. Milk and truck are chilled overnight—enough to keep them cold until the next night's chill. The Crouse-Hinds Company, Syracuse, N.Y., made the rack.

They Say Now .....

FRANK STANTON, PRESIDENT, COLUMBIA BROADCASTING SYSTEM: *"A nation whose living rooms are piped together, so to speak, via television, is a nation of greater cohesiveness than otherwise. But the unwanted twin of cohesiveness is conformity."*

ALVIN M. WEINBERG, OAK RIDGE NATIONAL LABORATORY: *"For the first time in the world's history, I believe military people have conceded that the explosives at their disposal are powerful enough."*

EDITORIAL, THE TIMES OF LONDON: *"If craftsmanship is passing in the trades . . . it flourishes as never before in the hobbies of those who have chosen—or been condemned—to earn a living with their heads."*

EZRA TAFT BENSON, SECRETARY OF AGRICULTURE: *"The housewife today buys time as well as food in the market."*

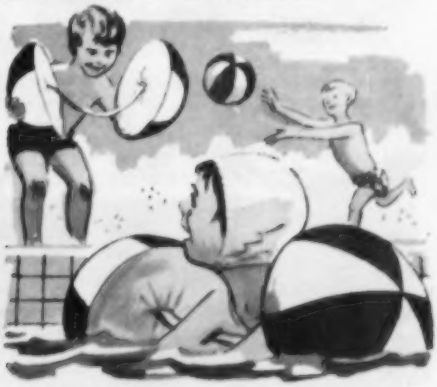
THOMAS E. MURRAY, COMMISSIONER, ATOMIC ENERGY COMMISSION: *"Our work in the field of nuclear propulsion both for ships and aircraft is just beginning."*

New Ideas
FROM THE INVENTORS

1 Truck Door to Cart Load. Fold-up wheels like these on a truck or trailer door would speed cargo handling. Covering about half the back of the van, the door would be hinged to open in the normal way. It could also be swung down to serve as a floor-high loading platform. Detached, the door could be wheeled away like a dolly.

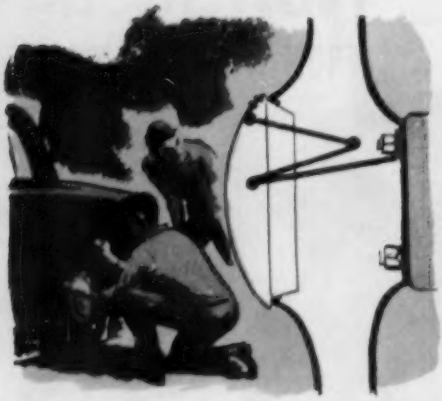
2 Lamp to Kill Bugs. Since light attracts insects, this bulb could be their undoing. An electric heating element wound on the outside of the globe would scorch any bug that flew close to the light. A reflector would focus both light and heat, help direct bugs in the vicinity to their doom.

3 Beach Ball to Convert to Wings. Spaced apart by an adjustable tape, these air-filled hemispheres would serve as water wings. When joined by snap fasteners placed around the rim, the halves would become a water ball. Recesses or pockets for the tape would be provided in the flat faces.



Please turn the page for more new ideas

MORE New Ideas from the Inventors



4 Hub Strap to Balk Pilferers. To make off with this protected hubcap, a thief would need a pry, a lug wrench, and plenty of time. The hinged strap riveted to the hubcap and bolted to a wheel lug would also prevent accidental loss. The cap would come off readily, however, when the wheel was removed in the ordinary way.

5 Driver to Grip Screw. A slight twist would lock the flared tip of this screwdriver into the beveled, undercut slot of the matching screw head. The slip-proof driver would be handy for starting, turning, or removing screws in hard-to-reach spots, but the special screw could also be turned with a standard-blade screwdriver.

7 Motor to Power Swimmer. Strapped to your chest this screened-in propeller would carry you through or under the water. It would leave your arms and legs free so you could steer or maneuver in the usual way or even practice unusual aquatic tricks. A gasoline or electric motor floating in a buoyant shell would drive the prop through a flexible shaft. A sheath enclosing the drive shaft and a speed-control cable bracketed to it would serve as a towline for the engine. The inventor says motorized swimming would be useful for lifesaving and military purposes as well as for sport.

6 Paintbrush to Turn Corners. By setting the bristles of this brush at an angle, you could paint the more difficult places without twisting or straining, or climbing to an unsafe perch. Made as a unit with the handle, the adjustable pivot mechanism could be screwed into the bristle-holding block of any conventional brush.

8 Weight to Tame Iron Cord. Slipped over the cord of an iron, this weighted pulley would uncurl the wire, keep it out of a user's way. The iron would plug into a tray spaced a few inches from the end of the board. A separate wire from the tray would connect to the wall outlet.

9 Toy to Exercise Dog. You wouldn't have to take so much exercise yourself to give Rover the amount he needs if you provided him with a wall-mounted spring like this. You could attach his favorite shoe or rubber bone to one end of the device and let him fight the spring for possession.

U.S. patents on these inventions have been granted to: 1. Kibbey Couse, Newark, N. J.; 2. Bryan Hanson, Yakima, Wash.; 3. Frederick Hornback, El Centro, Calif.; 4. James O'Day, Maplewood, Mo.; 5. John Lissy, Brooklyn, N. Y.; 6. Harold McClenahan, Omaha, Nebr.; 7. Louise Eckl, Munich, Germany; 8. N. Robinson, Southport, Conn.; 9. J. Hadley, Clayton, Mo.

Flying Firemen

Science challenges the storms that start fires

By Wesley S. Griswold

THIS summer, U.S. firemen of the woods know more about how to put out blazes in our forests than they ever did before. And they have good reason to hope that in a year or so they'll also know how to put out the lightning that kindles many of those blazes.

Their new knowledge was acquired in two large-scale scientific experiments. One, called Operation Firestop, began a year ago and ended last month. The other, Project Skyfire, is still going on.

Part of Operation Firestop took place on a 25-mile strip of rugged hills near San Diego, Calif. There the experimenters attacked 200 test fires with helicopters, small planes of the crop-dusting type, chemicals, a torpedo bomber and plain water. They set backfires with handfuls of tiny grenades tossed from the sky or touched off by electricity on the ground. Helicopters then hovered over the quick flames and fanned them into spreading to meet the main fires at twice natural speed.

Helicopters successfully dive-bombed spot fires with five-gallon plastic bags and 100-gallon canvas buckets of water. They whisked hose lines up steep, pathless slopes faster than water under pressure could move through the hoses. With special rigs, they speedily delivered big drums of water, pumps and hose to crews

A TROUBLE-SHOOTING COPTER starts unreeling several hundred feet of live (water-filled) hose as it begins a dash to deliver the nozzle end to a crew fighting fire on a nearby hill.

Save Forests

and perfects new airborne weapons to stop fires.

battling fire beyond the reach of trucks and jeeps.

Big copters hoisted entire crews from one critical area to the next. Small copters equipped with public-address systems amplified the commands of fire bosses and, with loudspeakers aimed straight down, carried them clearly to all ground crews as far as 3,000 feet away.

Fire-retardant chemicals, such as calcium chloride, monoammonium phosphate and borax solutions, gave a dramatic performance, too, in Firestop.

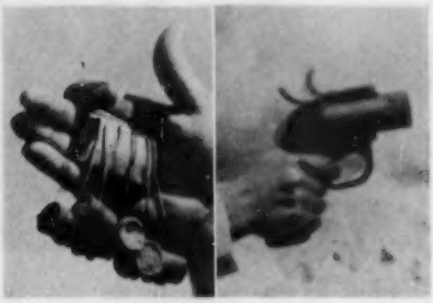
OFF TO A FAST START, a backfire races up a slope to meet the main blaze. The backfire was set by grenades tossed from the helicopter, which then fanned the flames with its rotor.

Sprayed on dry brush in the path of running fire, they forced the fire, once it had arrived at treated fuel, to drop from the crowns of the brush to the ground, where it was more easily fought. They also kept backfires within bounds.

The conventional way to backstop a backfire is to wet down brush behind the fire line and then clear a strip right down to dirt behind the soaked brush. This is not only time-consuming but only temporarily effective, because the brush dries out fast in the heat of the blaze and often ignites before the men clearing the strip have completed their job.

Here was the improved way they did it in Operation Firestop: A bulldozer pulling a tank of calcium chloride mashed down a line of brush. Men walking behind the bulldozer immediately sprayed the brush with fire-retardant

LETTING FLY WITH 600 GALLONS OF WATER, a made-over torpedo bomber demonstrates a quick way to drown spot fires. The water bomb can drench a third of an acre of burning bush.



TO FIGHT FIRE WITH FIRE, crews now touch off backfires with clusters of grenades the size of cocktail sausages (left) and with Very pistols that shoot flares 300 feet.

CONFINING A BACKFIRE to effective limits is accomplished here by spraying brush at its flanks and rear with fire-retardant chemicals. These chemicals even slow down bigger blazes.

chemical. Then the backfire was started, moving out towards the main fire from the treated strip. The chemical prevented the brush backstop from catching fire for hours, so that men were freed to do more vital work than standing guard over it and had far less mopping up to do after the main fire was out.

Weed-killer used. Chemicals with the opposite effect proved valuable when a backfire was needed in growth that was slow to burn. A small plane spewing a giant brew of weed-killer mixed with diesel oil swept back and forth over brushland that was green. Within six to eight hours, the spray had dried the brush so much that it would burn briskly.

If you felt like footing the bill, the nation's fire-fighting services would doubtless buy fleets of helicopters and small planes, and tons of chemicals, and make history this summer. But, out where the forests are biggest, even a small helicopter costs $100 an hour to rent, and to buy a helicopter big enough to transport a fire crew costs $340,000. Since the budgets are lean, the fire fighters have a small air force under charter and stretch it as far as they can.

Flamboyant maneuvers involving aircraft were not the only promising fire-fighting techniques or equipment trotted out during Operation Firestop. One earthbound routine of much merit involved use of recently introduced, lightweight aluminum six-inch pipe, with spring fasteners to snap the sections together. Three men demonstrated that they could lay 264 lengths of it—a mile—in an hour. Fine, but expensive.

Finding out how fires act. From anemometers strung on cables across canyons to sense and record the erratic behavior of canyon winds, from a galaxy of weather stations and wind towers scattered about the test tract, and from countless laboratory experiments, Operation Firestop gathered a great body of additional knowledge that is reaching the front lines of forest-fire fighters.

These facts, drab and often meaningless to a layman, are helping the fire bosses this summer to decide more quick-

A "HELITANK" ARRIVES at a critical point close to a fire line. It is a package of two 50-gallon drums of water, a pump and 300 feet of hose, self-releasing as it touches ground.

RELAY TANKS like this one, a big canvas bag, are necessary to enable pumps to land water on fires high in the mountains. The feed line here consists of six-inch aluminum pipe.

FOR A BROAD VIEW of cloud formation over forests, Project Skyfire scientists daily take 85-degree photos (right) with synchronized pairs of wide-angle still cameras.

ly and surely than ever before how a forest fire is going to act. This is of basic importance; it determines the tactics they use to try to stop the fire in its tracks.

Aim is prevention. Better than the ability to put out a forest fire, though, would be the ability to prevent it from starting. That is the goal of Project Skyfire, a slow-paced scientific experiment thinly spread over 28,000,000 acres of forest in the Rocky Mountain States and California. Now in its third year, Project Skyfire has spent two years in developing instruments and training observers to study the birth and growth of thunderstorms.

For two years, the little band of weather experts and forest rangers who conduct Skyfire has watched clouds form over the Sierras and Rockies day after day during the mild months and has taken innumerable pictures of them.

This summer, the staff of Project Skyfire intends to eliminate all but the most promising approach to throttling thunderstorms in their cradles. Next year it hopes to demonstrate that, by skillful cloud seeding, thunderstorms can be broken up before they are able to form. Thus lightning, which has shown itself capable of starting 400 fires in a day in a single section of American woodland, would be snuffed out before it could set the forests ablaze. END

KEEPING TABS ON STORMS that produce lightning, time-lapse movie cameras on the catwalks of fire-lookout stations in several Western forests record the life cycle of storm clouds.

AIR'S RELATION TO FIRES was extensively studied in Operation Firestop. Technicians with balloons and radar sampled temperature, humidity and winds up to 20,000 feet twice a day.

Engineers Build a Better Mouse

POKING cable through hundreds of feet of small conduit is a "pipe" now for New York's Con Edison. The Mouse—a tiny gadget with an eccentrically revolving weight inside and wire bristles all around—scurries through, dragging a wire "tail" behind.

Towers to Span Wild Frontier

GIANT aluminum towers like this one will soon carry electric current over 49 rugged miles of northern British Columbia for the Aluminum Company of Canada. They range in height from 74 to 139 feet, but weigh, on an average, only 25.8 tons.

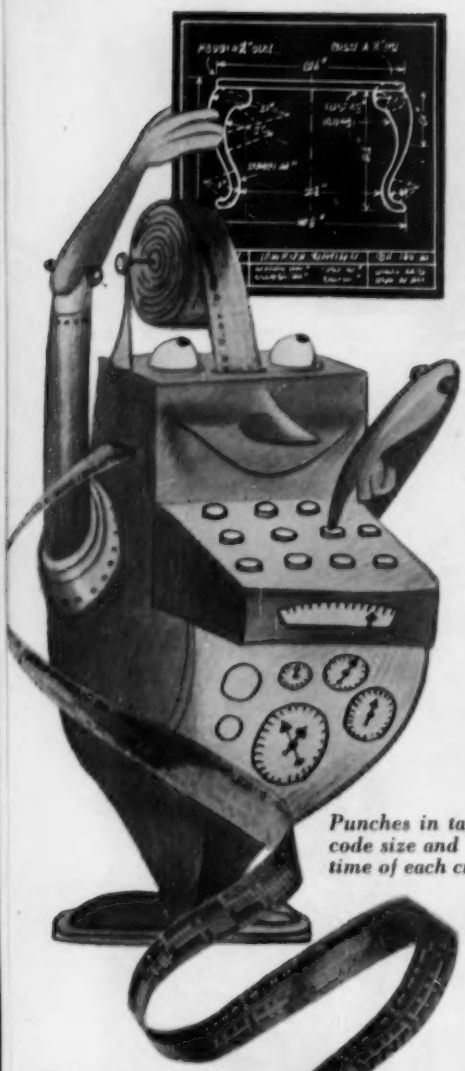
Ladders Put Firemen on Air

FIREMEN are discovering a new use for their ladders: as emergency radio-antenna towers. The idea, hit on by Chicago's Fire Department, is shown being tested by Milwaukee firemen. The antenna, clamped to the ladder, can be erected in seconds.

In an electronic lab at MIT, engineers now are

Teaching Power Tools to Run Themselves

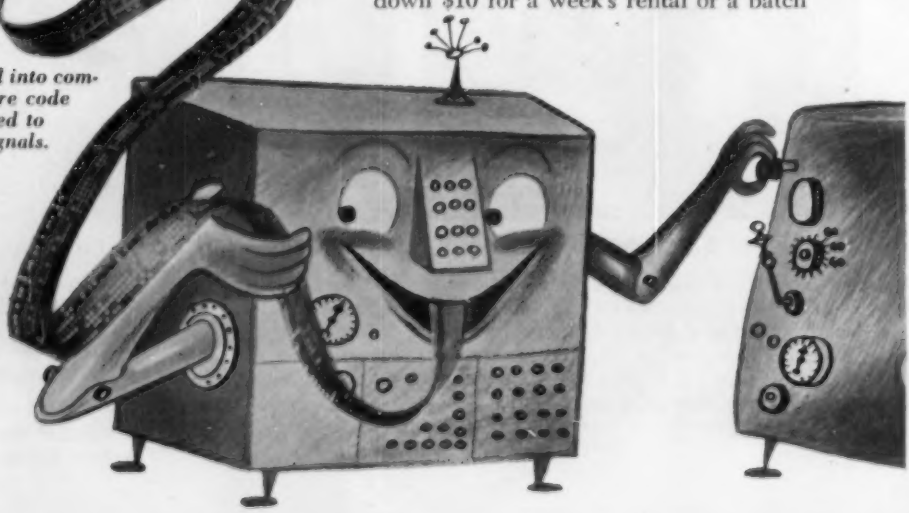
By Hartley E. Howe



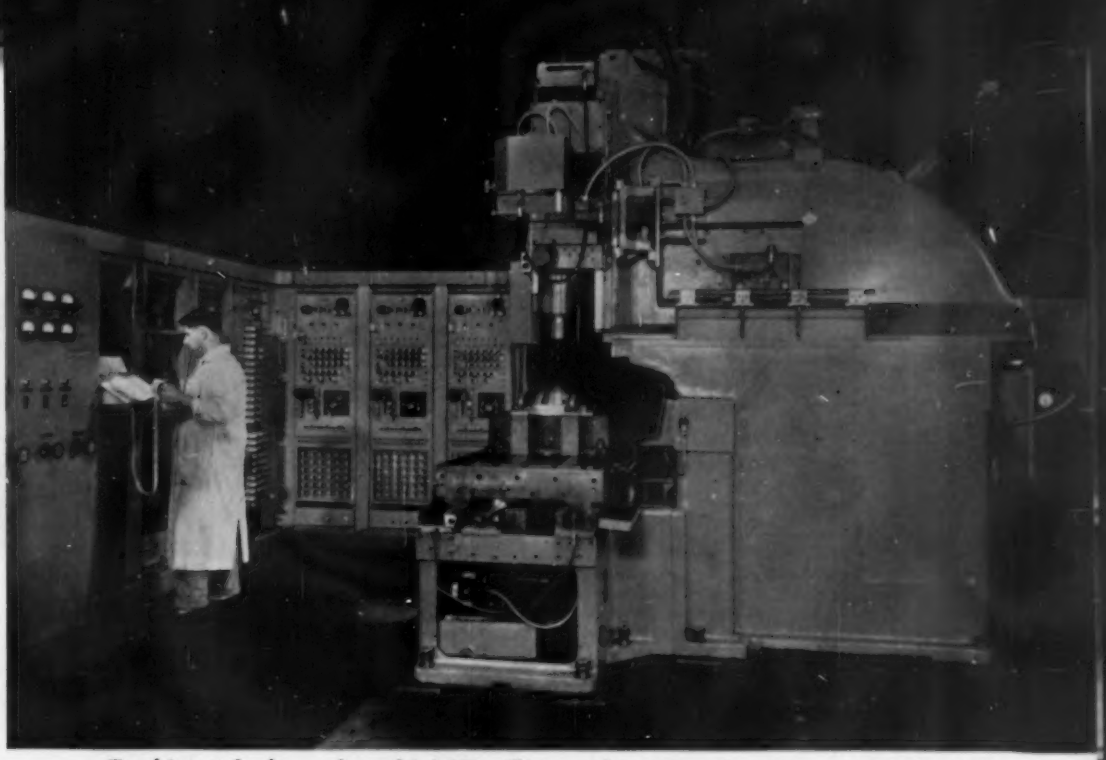
Punches in tape code size and time of each cut.

SO JOE WORKSHOPPER figures he'd like to turn out a set of dining-room chairs—and at the same time break in his new Model 100 Super Tapemaster. Joe whips down to the hardware store and looks over photographs of different designs. He settles on a Swedish pattern popular 'way back in 1955—delicate and handsome, but full of difficult reverse curves.

That doesn't worry Joe. He plunks down $10 for a week's rental of a batch



Tape is fed into computer where code is converted to electric signals.



Too big yet for home shop, this MIT milling machine is run by computer-control at left.

of tapes—one each for legs, arms, back and seat.

That night, he clamps a nice piece of birch into his Tapemaster, slips the tape into the control box, flips the switch, and sits back with his pipe and the new issue of *Outdoor Life*.

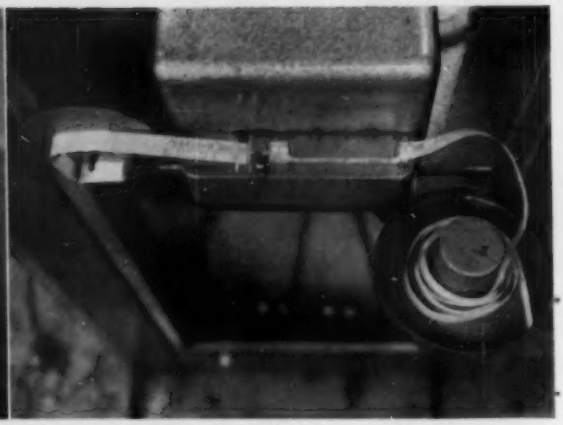
Forty minutes later, the rumble of the Tapemaster stops and Joe takes a look. One leg is finished. So he clamps on another piece of birch . . .

Sure it's a dream—in 1955. But the engineering basis for Joe's Tapemaster exists right now. Sitting up in the Servomechanisms Laboratory of the Massachusetts Institute of Technology in Cambridge, Mass., is a milling machine that will turn out any metal part at the command of a little roll of tape. Originally a standard, vertical 28″ Cincinnati Hydro-Tel, it now has hitched to it $50,000 worth of electronics.

To conceive, design and build the MIT machine took some quarter-million

Signals control three-dimensional movement of cutter head, time each cut.

PAPER TAPE is punched on standard equipment used in teletypewriters. Operator follows code directions, in which blueprint lines have been changed to column of figures.



TAPE READER pushes needlelike fingers against paper strip. Wherever there is a hole, steel finger goes through and completes an electrical circuit, sending a code signal.

dollars, 250 electron tubes, 280 pilot lights, 175 relays—and brilliant engineering on the part of Tech's Department of Electrical Engineering. As father of a whole new family of machine tools, it will earn its keep many times over.

What we can expect. Whether such industrial giants can be scaled down to home-shop size and price is anybody's guess. But it is no guess that these tape-eaters are going to bring a lot of eye-opening changes to industry. Someday, perhaps . . .

- A remote overseas base will be able to make a desperately needed part in a few hours by plugging a machine tool into a radio receiver.
- Machines in factories spotted across the country will all be controlled from one central headquarters.
- Little machine shops will be able to do big jobs by buying or renting control tapes.
- Automobiles may change design more often—perhaps even seasonally—thanks to tapes that cut tooling-up costs.

Three things make all this possible: First, blueprints can be converted into numbers (hence the name "Numerical Control"). Second, the numbers can be converted into a perforated paper tape which generates electric signals. Third, the signals can operate controls of a machine tool—to make the part on the blueprint.

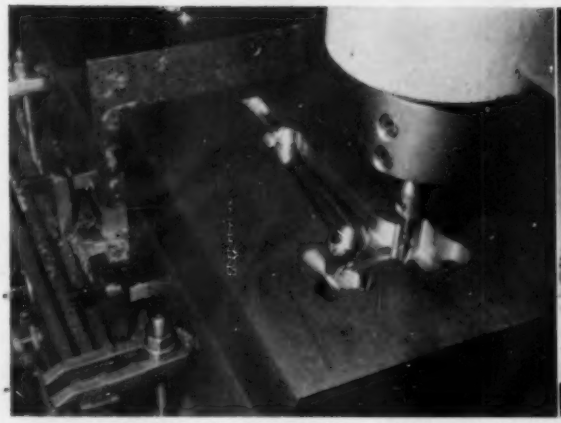
Turning a blueprint into holes in a tape—"programming," they call it—requires a man who knows machining, tools and metals. He has to break up every curve in the design into straight lines. The automatic machine cuts straight lines only—but they can be as short as .0005 inch. A series of such lines is a curve for all practical purposes.

The programmer next translates each straight line into numbers. Three numbers represent distance of cut in each direction: up or down, back or forth, sideways. A fourth number tells the time the cut will take.

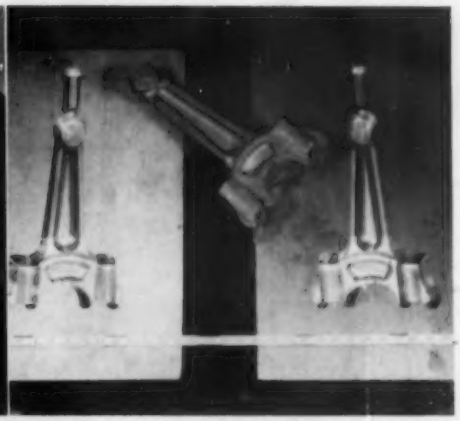
Typing out a pattern. The programmer then codes the numbers into a pattern of holes in the slim paper tape by operating a typewriter-like machine. This machine, and the tape it makes, are much like the ones used for high-speed Teletypes.

The programmer's final job is to feed the tape into the machine director, essentially an electronic computer. From now on the machine is on its own.

When the tape is run through the director, tiny steel needles finger the holes and read the numbers, changing them into electrical signals. These signals can be recorded, transmitted by radio or wire,



DIE BLOCK for master piston rod of a radial aircraft engine was cut automatically in solid steel, using tape controls. Run was continuous except for halt to change cutter.



PAIR OF DIES is checked against a dummy piston rod molded in dies made in earlier run. Exact fit showed complete duplication resulting from re-use of the same control tape.

and reproduced anywhere in the world.

From these signals, the computer figures the rate of feed and orders servomechanisms to adjust the speed controls of the machine's three hydraulic feeds.

The actual movement of the cutter through the metal may be momentarily slower or faster than expected because of variations in metal hardness and dulling of the cutting edge.

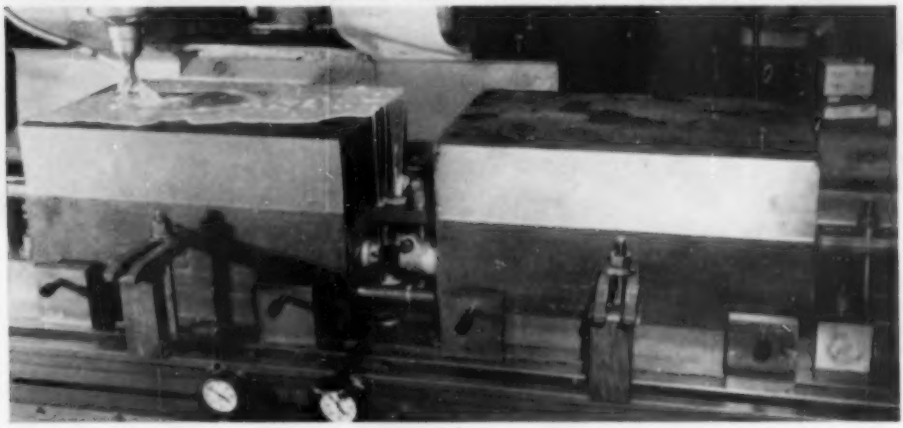
To catch such errors, the computer constantly inspects both the orders received by the servos and the actual movement of the cutting tool. If either differs from that on the tape, the computer automatically sends corrections.

These "feedback" inspections do a good job. The control system is accurate to .0005 inch, much more precise than the .002-to-.004-inch tolerance of the machine itself.

Despite its complexity, the numerically controlled machine is dependable. If anything goes wrong in the controls or machine, alarm circuits stop everything before the work can be damaged. In thousands of hours of operation, the elec-

[*Continued on page 222*]

NO HUMAN OPERATOR had to watch work, so blocks were covered with wetting agent during die cutting. This speeded work, reduced cutter wear. Note next block ready on table.



New Aids to Living...

1 These laces can't flap—there are no bows to come untied. They anchor in top and bottom eyelets and are elastic so you can slide the laced shoes on and off like bedroom slippers.

2 A blow-up crib made of Krene plastic lets Baby doze wherever he goes. It will fence in a baby of pre-crawl age for travel on a car seat or Pullman berth, and will bed him down safely on a full-size bed at journey's end. Deflated and folded, it fits conveniently into a diaper bag.

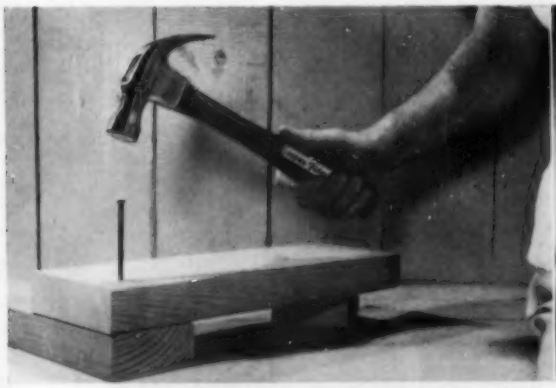
5 Ice sealed in plastic (above) makes any container a portable cooler. Built-in super-ice (a special substance) won't melt for hours and can be refrozen whenever you plan a picnic jaunt, a shopping trek for frozen foods, or a trip with baby bottles.

6 Errors are washed out instead of scrubbed away when a new kind of typewriter ribbon is used. The Dele-e-tape is teamed up with a liquid eradicator that makes corrections less noticeable and eliminates holes from abrasion.

Further information about these products can be obtained from: 1. Cecil Corp., 307 N. Michigan Ave., Chicago 1; 2. Bardell Mfg. Corp., 21 E. 34th St., Steger, Ill.; 3. Carradan Associates, 154 E. Erie St., Chicago 11; 4. Arsco American, Inc., 3308 Edson Ave.,

3 A floating bubble of light, the ceiling fixture above weighs less than two pounds. Its plastic shade is blown up around lamp bulbs fitted into a wire frame. Pulling the cords raises or lowers the lamp. It is sold in kit form, is easily assembled.

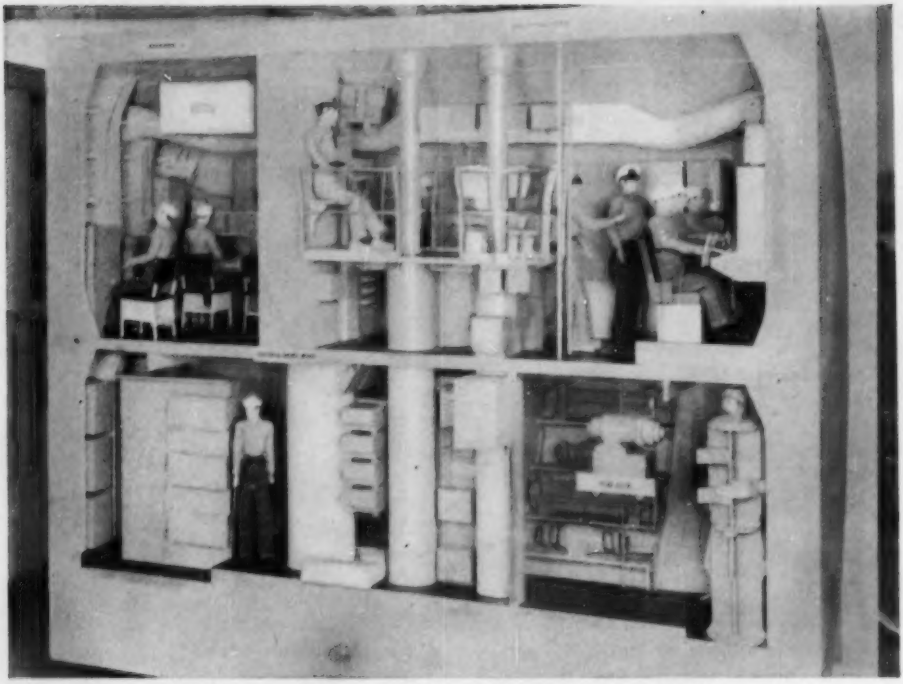
4 An aluminum stand turns any board into a drawing table that can be raised for standing at your work or lowered for sit-down jobs. The board can be swiveled or tilted, then locked securely, when the screw-on mount is dropped into the tripod.



7 A hammer handle stronger than steel but with the resilience of traditional hickory results, it is claimed, from using Fiberglas-reinforced plastic. The head, says the maker, can't come off. Careful molding gives the hammer proper balance.

8 Stickum in a tube teams up with an applicator that works like a ball-point pen. When you press down on the ball tip, it releases a pressure-sensitive, rubber-base adhesive that grips firmly. Excess can be peeled or rubbed off with a finger.

NYC 69; 5. "Bud" Wilson, Inc., 232 S. Beverly Dr., Beverly Hills, Calif.; 6. Aetna Products Co., Hicksville, N.Y.; 7. Fayette R. Plumb, Inc., 4837 James, Philadelphia; 8. Glutex, Inc., 2063 E. 37th St., Brooklyn 34, N.Y.

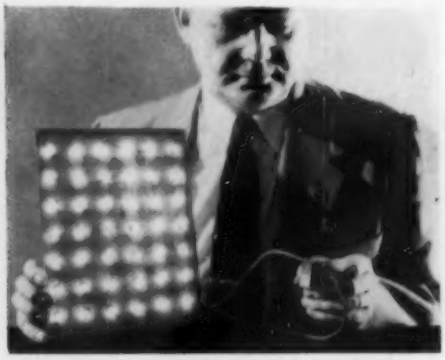


Nautical "Dollhouse" Helps Check Submarine Design

SUBMARINE designers at the Mare Island Naval Shipyard in Vallejo, Calif., are playing with dolls. In a quarter-scale, 67½-foot model, experts experiment with arrangements of equipment to insure that all gear will fit, that hatches will open properly and that the sailors will have sufficient room to live and work in comfort.

44 Tags All Show One Number

ELMER F. RIETZ of Skokie, Ill., has no trouble remembering his license number—he's had it for 44 years and he has saved the plates. He would have still more plates if Illinois had given them out, but prior to 1911 every Illinois motorist made his own.

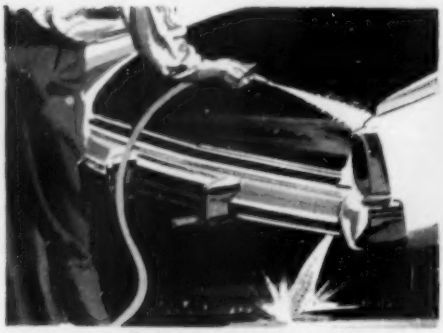


Tiny Battery Gets a Glow On

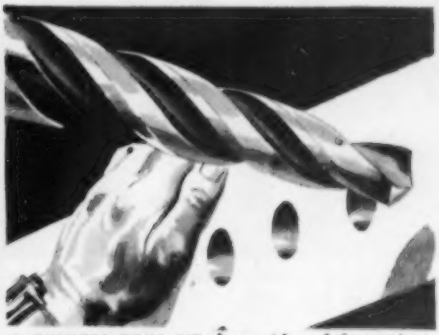
A THREE-CELL sample of the world's smallest rechargeable storage battery lighted the massed bulbs above. The silver-zinc unit, made by Yardney Electric Corp., New York, will be used in guided missiles, torpedoes and ultrasensitive equipment.

I'd Like to see them make...

A SALAD-STACKING RACK for the refrigerator. Salads made ahead of time could be kept chilled in the rack right on the serving plates. —*Mrs. D. M. Surrett, Fillmore, Calif.*



A CAR-TRUNK DRAINAGE VENT so the rear compartment could be flushed clean after hauling plants in soil, bags of cement, or other messy freight.—*Donald Lovelady, Big Spring, Tex.*

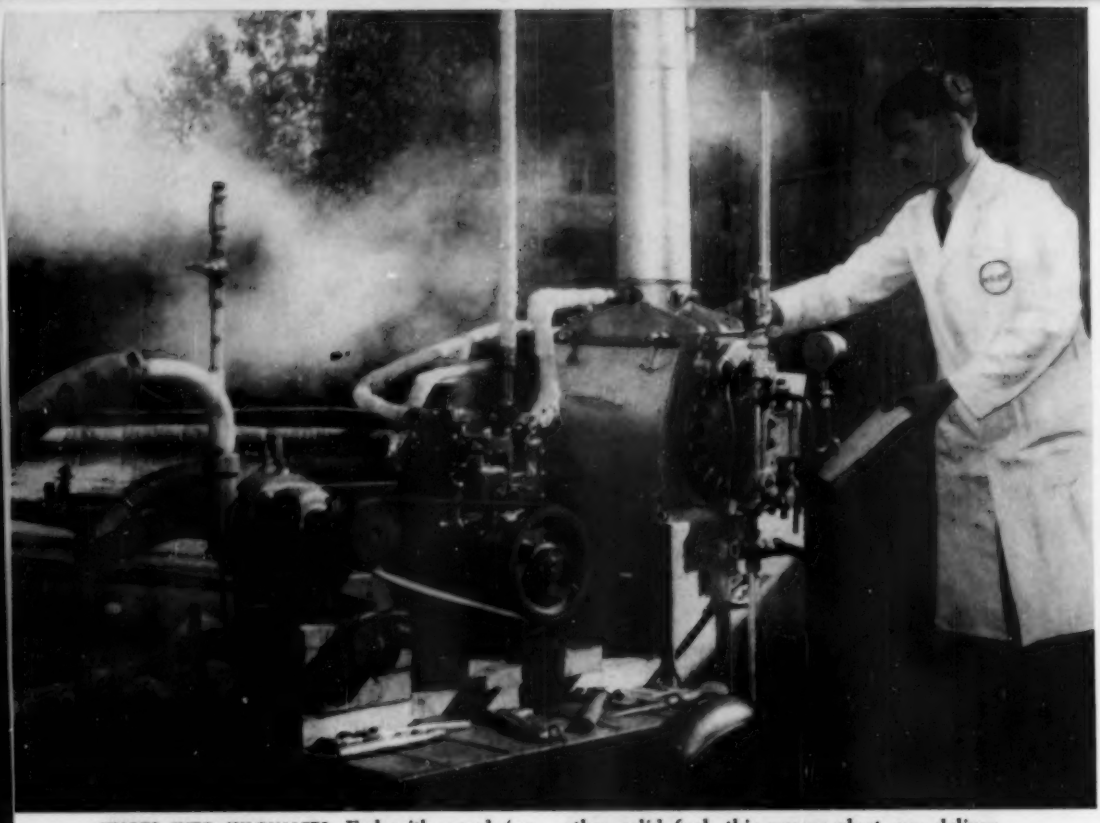


A CONICAL DRILL BIT that widened from tip to shank, to enlarge the hole as it bored. This would eliminate bit changing when you bored a through hole.—*D. Dorn, Fort Morgan, Colo.*

A HOLD-DOWN GARBAGE CAN with a bracket at the bottom. Planting your foot on it would let you lift off the cover with one hand.—*Frank Cerra, Homestead Park, Pa.*

A LIFEGUARD'S GUN that would shoot a collapsed life preserver. A CO_2 capsule would inflate it automatically as it hit the water.—*Bill Hauda, Sault Ste. Marie, Mich.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.



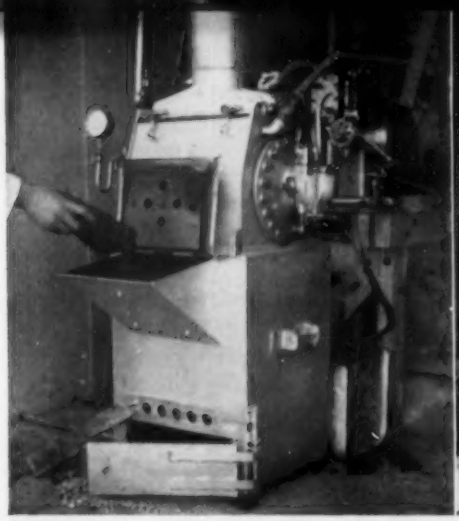
KNOTS INTO KILOWATTS. Fed with wood (as shown), or with peat, cane, grain stalks or any other solid fuel, this power plant can deliver 1,800 watts of electricity and do many chores.

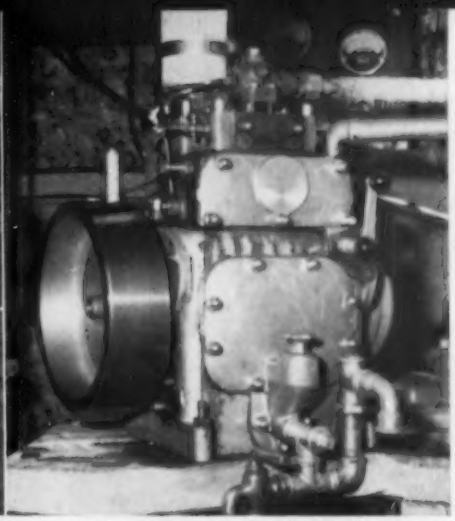
Gas-Engine Wizard Turns to Steam Power

HOW modern can a steam engine get? Many an armchair mechanic has wondered what this old-timer would be like today, if the internal-combustion engine hadn't shoved its development off the calendar.

One way to find out is to assign a gas-engine expert to the job of updating it. That's what England has done. The result is a steam plant that can bring power and electricity to remote places, is safe for anybody to operate, burns just about anything for fuel, and may cost no more than a diesel of equivalent size.

The expert responsible is Sir Harry Ricardo, best known in this country as the inventor of the Ricardo head for gasoline engines. Now past 70, this famous consulting engineer has been a major figure in the development of auto and aircraft engines. Recently he received the Society of Automotive Engineers' Horning Award, a tribute to his years of research on engines and fuels.

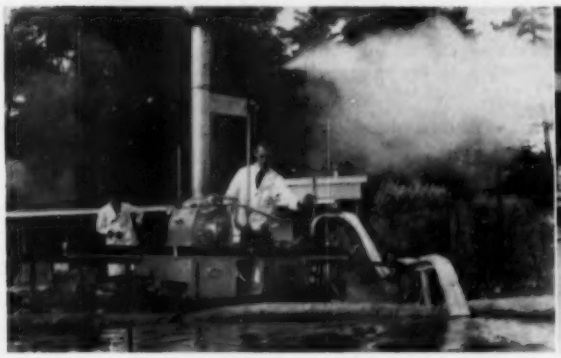




READY TO FIRE, boiler weighs 250 pounds. Fuel is dropped in from side. Two-cylinder engine (above right) weighs only 80 pounds. With an eye to cheapness and possible local manufacture, many die-cast parts are used. Cost may eventually be cut to that of equivalent diesel.

British engineer builds foolproof boiler and easy-to-run engine that will burn any fuel from cornstalks to coal.

HOOKED TO A PUMP, the steam plant can deliver 5,000 gallons of water per hour. If operated only eight hours per day, this should irrigate up to 15 acres of farmland.

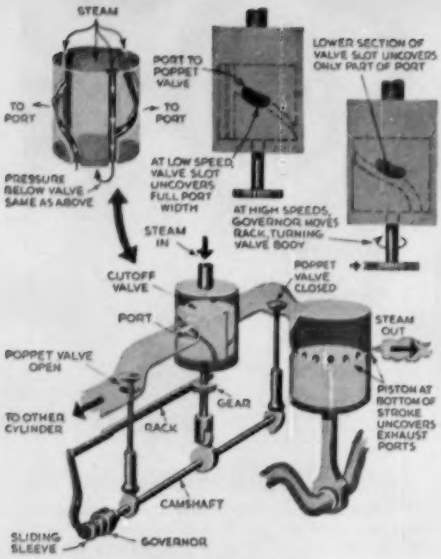


HOME ON THE RANGE. Far from power lines, the generating plant could run all lights and appliances in a small home—including the kitchen sink, for which its exhaust would heat water.

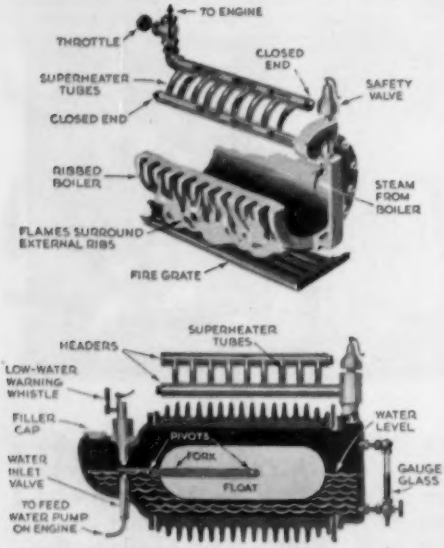
Substitute for the bullock. What underdeveloped countries need is an engine that can "live off the land" by burning peat, brushwood, sawdust, stalks and other waste instead of costly gasoline or oil. India, for example, couldn't foot the $300,000,000 yearly oil bill for running just one five-hp. diesel in each of its villages now without any form of power.

Besides burning cheap fuel, the engine must be low in cost and reasonably foolproof. Wrestling with this problem, the British government-sponsored National Research Development Corporation called on Sir Harry. Months of work brought forth a steam plant that almost runs itself, neatly solving problems that have bedeviled other such rigs. It will automatically keep its boiler filled, maintain a given speed setting, and whistle for help if its water supply should run dry.

Boiler brought up to date. The new twist starts with the boiler, which has no



POPPET VALVES open at start of each down stroke, while steam exhausts through wall ports at end of stroke. Cam-driven cutoff valve in center uncovers port to one poppet valve when up, to the other when down. Length of time steam is admitted is governed by rotational position of the valve body, which is controlled by a centrifugal governor, rack and pinion.



SELF-REGULATING BOILER is a thick-walled aluminum cylinder with external ribs. From this steam passes into a closed header, through superheater tubes in the path of hot gases, and into a take-off header to throttle and engine. Big float, internally braced to withstand boiler pressure, fills large part of the shell. Water pump works whenever engine runs, but water is admitted only when float drops to open inlet valve. Cap is for initial filling.

water tubes to be clogged or develop leaks (it has superheater tubes, but only steam enters these). The main shell is an aluminum-alloy drum with a perfectly smooth inner wall, which can be cleaned by unbolting detachable ends. Having no tubes, the boiler can use moderately dirty or salty water.

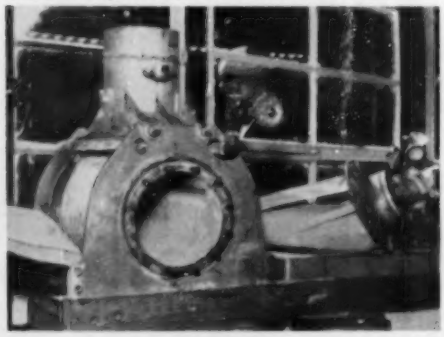
Deep external ribs strengthen the drum and speed heat transfer. A large float inside reduces the volume of water exposed to the heating surface, so promoting fast steaming. The float actuates a valve that admits water from a pump on the engine. Should pump or water supply fail, the float falls enough to sound a whistle. Should an overenthusiastic fireman get things too hot, a safety valve blows off. Working pressure is 150 p.s.i.

The boiler is mounted on a simple fire box with grate bars spaced for the kind of fuel to be used. A sheet-metal stack provides draft, which can be increased if necessary by turning the engine exhaust up the stack.

Engine heats water. Sir Harry Ricardo's power unit delivers 2½ hp. at 1,250 r.p.m. Its two cylinders are 2¼ inches bore by 2½ inches stroke. Specific steam consumption is only 30 pounds per horsepower-hour—about half that of ordinary steam engines.

Like a gas engine, it is single acting; steam is admitted at the top of the stroke by a poppet valve. At the bottom of the

WITH END UNBOLTED, boiler is easily cleaned. External ribs can be seen below at left. Float in its fork, attached to end of boiler, is at extreme right. Flames must pass between ribs and outer casing to reach the stack.



stroke, the piston uncovers exhaust ports in the cylinder walls. Exhaust steam goes through a heat exchanger, where it raises the temperature of the feed water going to the boiler, so saving fuel.

Automatic valve meters steam. The high efficiency of the engine is due largely to a unique cutoff valve, which regulates the amount of steam admitted at each stroke. Like the poppet valves (which open fully during each down stroke) this cutoff valve is lifted by a cam. When up, it delivers steam to one poppet valve; when down, to the other. Steam passes through helical slots on the

ENGINE OIL IS DISTRIBUTED by timer chain, which runs over idler sprocket placed low in crankcase. Two-cylinder block is at center above. The poppet valves, with cutoff valve between them, are mounted in the cylinder head; this is held in hands at left above.

outside of the valve spool, which line up with ports in the housing.

Besides reciprocating, the valve body can also turn on its own axis. A gear is mounted on its spindle through a sliding slot-and-pin joint. The gear engages a rack connected to a centrifugal governor.

When the rack and gear turn the valve clockwise, the helical steam slots uncover less than the full port area, thus decreasing the amount of steam supplied. A lever controlling spring tension against the governor has six settings. It can be changed without stopping the engine.

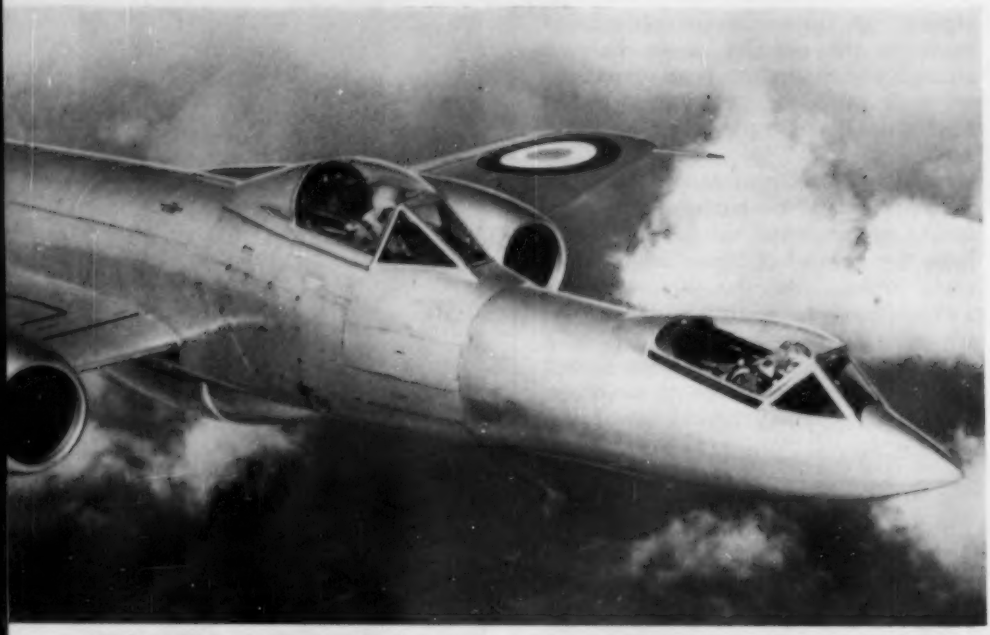
Oil is picked up by the timing chain that drives the camshaft and is thrown against the valve and cylinder walls, while some collects in trays and is picked up by the con-rod bearings. For starting, a built-in hand pump injects oil into the steam chamber. END

Locusts Run Merry-Go-Round

IN STUDYING migratory habits of locusts, British scientists have hit on a novel way of finding out how far and how long these destructive insects can fly. They do it by fastening several of them to a hoop (above). As the suspended locusts flap their wings in flight, they turn the ring which is attached by strings from a free-spinning cork atop the center pole.

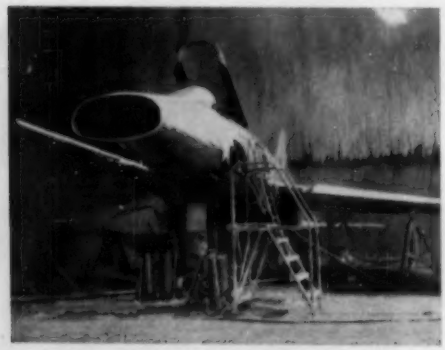
Camp Trailer Has Triple Use

HITCHED behind an auto, this German trailer hauls camping equipment. Put up the canvas top, which has plastic windows and mosquito netting, and it is a cozy sleeper for two. Attach an outboard motor, and it is a boat. The four-by-seven-foot trailer was shown recently at the Wiesbaden International Sports Equipment Fair.



Pilot Flies Experimental British Jet in Prone Position

A JET is being flown experimentally in England by a pilot lying on his stomach (in nose, above). Reason: The Royal Air Force wants to determine whether the prone position reduces the "G" forces a pilot is subjected to, and whether it is practical to cut down the Meteor's frontal area. A check pilot rides behind.



Super Sabre Goes in Deep Freeze

THE first operational aircraft to exceed the speed of sound in normal level flight is going through something new. The F-100 Super Sabre, above, was put into a climatic hangar, operated by the U. S. Air Proving Ground Command, in a temperature 65 degrees below zero to simulate the coldest point on earth. It is also being tested at plus 165 degrees.

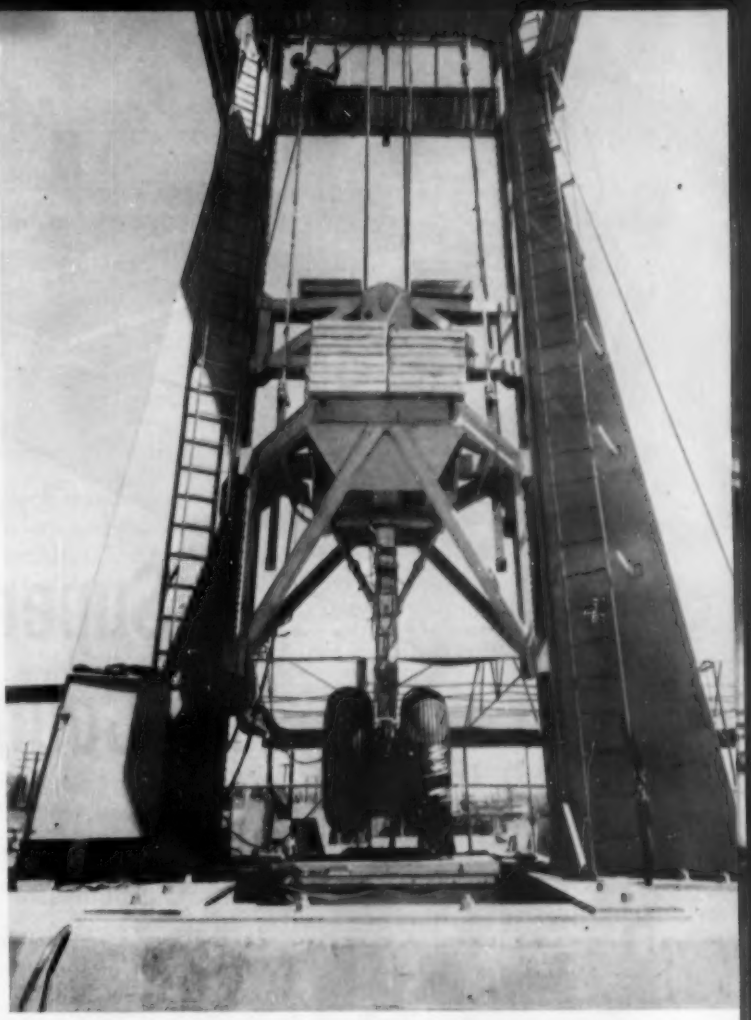
Jet Trainers Get Trolley Ride

TO HURRY up the preflight checks on its standard T-33 jet trainers, the U. S. Air Force puts them on a trolley. Planes coming off the assembly line at the Air Force's jet manufacturing center at Palmdale, Calif., are loaded onto dollies that run on rails. As the engines are revved up and the controls tested, a tractor pulls the mechanized "flight line" along from station to station.

Drop Tower Shock-Tests Landing Gear

How beefy must an airplane's landing gear be to take the punishment of repeated impacts with the ground? To find out, Lockheed's research center is letting gear fall with lead weights attached. The weights represent the impact force of a Constellation airliner. The drop tower is 40 feet high. Measurements are taken with strain gauges manufactured by Baldwin-Lima-Hamilton Corp., Philadelphia.

▶▶▶Safe-flying note: Automobile gasoline, with its high vapor pressure, can be extremely dangerous when it is used in aircraft, warns the Civil Aeronautics Administration. In the summertime, the possibility of vapor lock with the wrong gas increases sharply.



Look, No Motor! Air-Driven Fan Reels in Air Force Target

THE Air Force has figured out a way to get its tow targets winched back to their tow planes without installing expensive electric motors.

A fan, with a winch on the same shaft, is put in a special nacelle and capped in front with a butterfly valve (below, left). When the tow target (right) is paid out on its rope, the valve is closed and the fan turns freely. To reel the target in, the valve is opened, and ram air whirls the fan—and, along with it, the winch.

NO WORLD'S FAIR, this is the main shopping area. There's more parking space under it.

Super Suburb Is a Country City

By Darrell Huff

Big Builder

Frank W. Sharp, 48, for whom the super suburb is named. Once before he built "world's biggest"—6,500 homes.

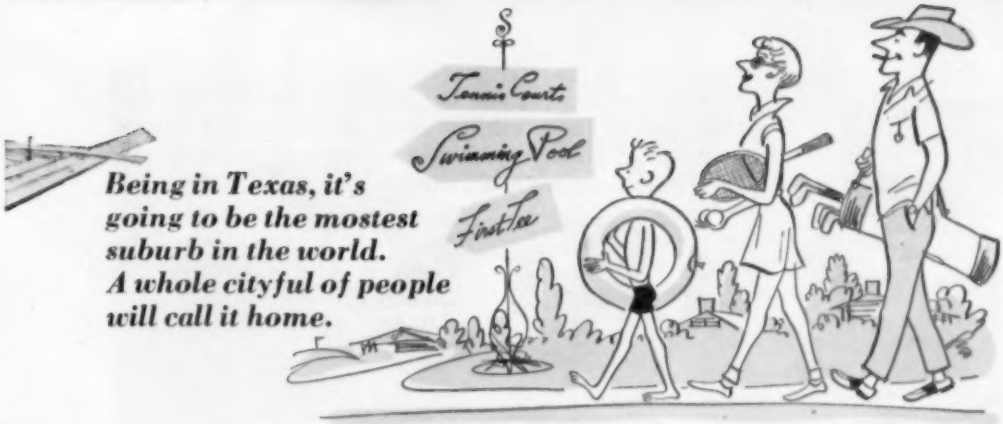
ON THE gusty plains at the edge of Houston, Texans are building—on Texas scale—the Suburb of Tomorrow. It's billed, natch, as the biggest real-estate subdivision in the world: 25,000 homes, 100,000 people.

Sheer size is the least of the story.

The $400,000,000 they're spending on Sharpstown, Texas, will also buy such dream-stuff trimmings as a built-in heliport and air-conditioned moving sidewalks. As a sort of pilot plant for life tomorrow, it may have a good deal of influence on how you will live, wherever you live.

If you were to become a resident of Sharpstown you would—first of all—find yourself a member of one of several country clubs. A plush one, too, with tennis courts, swimming pools, a fine golf course, and such added amenities as separate practice area with driving range and 36-hole putting green. Possibly this may strike you as a bit rich for the blood of a man buying a home in Sharpstown's $12,500 to $16,800 price range. So maybe you'd like to skip country-clubbing. No soap. Membership costs $20 a year for your whole family, and it is compulsory. You can't buy a home in Sharpstown without taking club membership.

Your home will be in the same cost bracket as those of your neighbors, and will be on a plot of uniform 60- by 120-



Being in Texas, it's going to be the mostest suburb in the world. A whole cityful of people will call it home.

foot size. But it won't look standardized: you'll be able to choose from various modern and traditional designs offered by at least 52 different builders. The house will have to have at least 1,000 square feet of floor space, and it will have to meet the approval of an architectural committee—a proviso intended to keep out the bizarre and tasteless. If you're feeling flush, you may want to look at a few of the larger houses offered. On 90- by 160-foot lots bordering the country clubs, these will cost up to $30,000.

Everybody's going to belong to the country-club set. You can't buy a house if you don't join the club.

Commute by helicopter. Your street will be curved and laid out to discourage through traffic. It will provide quick access to a four-lane highway and a new superhighway. But for your daily trips to work in the city, you may prefer to commute by helicopter. The heliport atop the five-story building in the main shopping center will provide shuttle service to downtown Houston. Measured in minutes, the new suburb will be closer to the center of the city than close-in residential districts now are.

No Gingerbread Castles Allowed

While houses won't look alike, rugged individualists will have to submit unusual designs to architectural committee for okay.

At the heliport you'll find yourself surrounded by other surprises. One is an unexciting but vastly enjoyable virtue that older, unplanned cities have lost: parking space. For each square foot of shopping area at least four square feet of parking space have been set aside. Some is at ground level, the rest in vertical automatic garages to hold as many as 500 cars apiece.

Ride, don't walk. In the main shopping center you won't have to walk to get from one shop to another. Just step aboard one of a pair of moving belts, two feet wide, and you'll glide effortlessly along an air-conditioned arcade. Unlike the country clubs, though, the moving sidewalks will not be compulsory. As a concession to fuddyduddies, the belts will be divided by an old-fashioned stationary sidewalk.

Smaller shopping areas spotted around will be miniatures of the main center. At these you'll probably have to walk

Commuting by Chopper

Whirly-buses are to give fast hops downtown. If you're an old stick-in-the-mud, you can drive your car instead.

Power-Assist Walking

Moving sidewalks in shopping center will save you the fatigue involved in spending your money.

between car and counter, but you won't have to tote your own parcels. These will march off by moving belt to your parking lot, where you will collect them as you drive out.

In true Texas tradition, everything about Sharpstown is rapidly getting bigger than even its spark plug, a tall Texan named Frank W. Sharp, originally intended. A year ago the plans called for 15,000 homes; the figure hopped to 25,000 after Sharp swung a $6,000,000 deal for an extra chunk of land. Such large amounts are of course necessary for projects like this. Not that Sharp was the only man to see the tract's possibilities. Others had seen them and had been scared off by what looked to be an impossible drainage situation. Sharp licked that one, 16 miles of culverts and all, in just 120 days of slambang work.

A farm boy from East Texas, Sharp started out after high school as a carpenter's helper. He studied bookkeeping nights at business college, finishing up by throwing a graduation party for himself, to which he invited the other students at so much a head. Afterward he made a speech:

"This dance has netted $80," Sharp told his classmates happily. "That's my farewell present—from you to me."

Put in long hours. He went on to study accounting, putting three nights a week into it, along with a six-day-a-week job in a bank, and three nights a week selling insurance. To this day he has little patience with associates who assume that everything stops at five p.m. He borrowed $150 from a bank, used it as earnest money to build a duplex, and sold it at a good profit. With this financing he began to build small subdivisions, leading up to his first biggest-in-the-world development in 1946. This subdivision, originally planned for 4,000 homes, seemed as gargantuan then as Sharpstown does now. But Sharp swung it readily, even blowing it up to 6,500 homes before he was through.

By the time he announced plans for Sharpstown in 1954, he was an old hand at just about every aspect of the job. He also learned to assign authority and to communicate his enthusiasm to those who work for him.

Perhaps that's why things are moving so fast in Sharpstown today. Streets for the first section are in. All 2,400 homesites in this section have been snapped up by the builders, and the first buyers are living in their homes. Along the sides of the fairways of the first golf course 800 transplanted trees are getting taller every day. END

New trigger mechanism gives this lightweight hunting rifle the speed of lever action, the power and accuracy of bolt-action jobs. A rotating front-locking bolt lets you work the lever without moving your finger from the trigger. The 6½-pound Winchester 88 is chambered to fire a hard-hitting .308 cartridge. The rifle has a one-piece stock.

New for Sportsmen

A stepped roof cuts bulk on this cabin cruiser, yet provides plenty of headroom in the galley. Bunks fit under the lower step. To cut vibration, the outboard motor rides a shock-absorbing "flying transom" outside the hull. The boat comes in kit form.

Lure screws loose. Snag the hook of the 30-30 fishing lure and you can still get it free. Pumping the line works a spring-loaded ratchet that backs off the lure, leaving behind only a threaded hook pin. New pins cost about six cents.

Off-links golf game lets you practice tough chip shots—or wham away. Perforated balls of Bakelite polyethylene take the impact without damage. Lowering the cup of the Chip-In set enables you to get in some practice on your putting.

Further information about the products on this page can be obtained from: (Rifle) Olin Mathieson Chemical Corp., 460 Park Ave., NYC; (Boat) Custom Craft, 1700 Niagara St., Buffalo 7, N.Y.; (Lure) Netcraft Co., 3101 Sylvania Ave., Toledo, Ohio; (Game) Cosom Industries, Inc., 6012 Wayzata Blvd., Minneapolis 16.

We're at the start of the era of push-button warfare—with "birds" that seek the target and will even span the ocean.

By Devon Francis

PHOTOS BY W. W. MORRIS

How Strong

ONE autumn day in 1944 a team of military intelligence men took off from Washington, D. C., for France on an emergency mission. Their orders were explicit: to get everything they could on the missiles the Germans were firing against Allied aircraft, shipping and cities.

The project was top-secret.

Today, almost 11 years later, the subject of missiles is still top-secret. But there is a difference. In the closing year of World War II this country, with a profound ignorance of missiles, had to borrow or purloin foreign know-how. Today we have stocked a pretty good missile arsenal of our own.

The meaning is plain—the year 1955 is ushering in the *beginnings* of the era of push-button warfare by missile, if war should come. Missiles we have, and they work by push button.

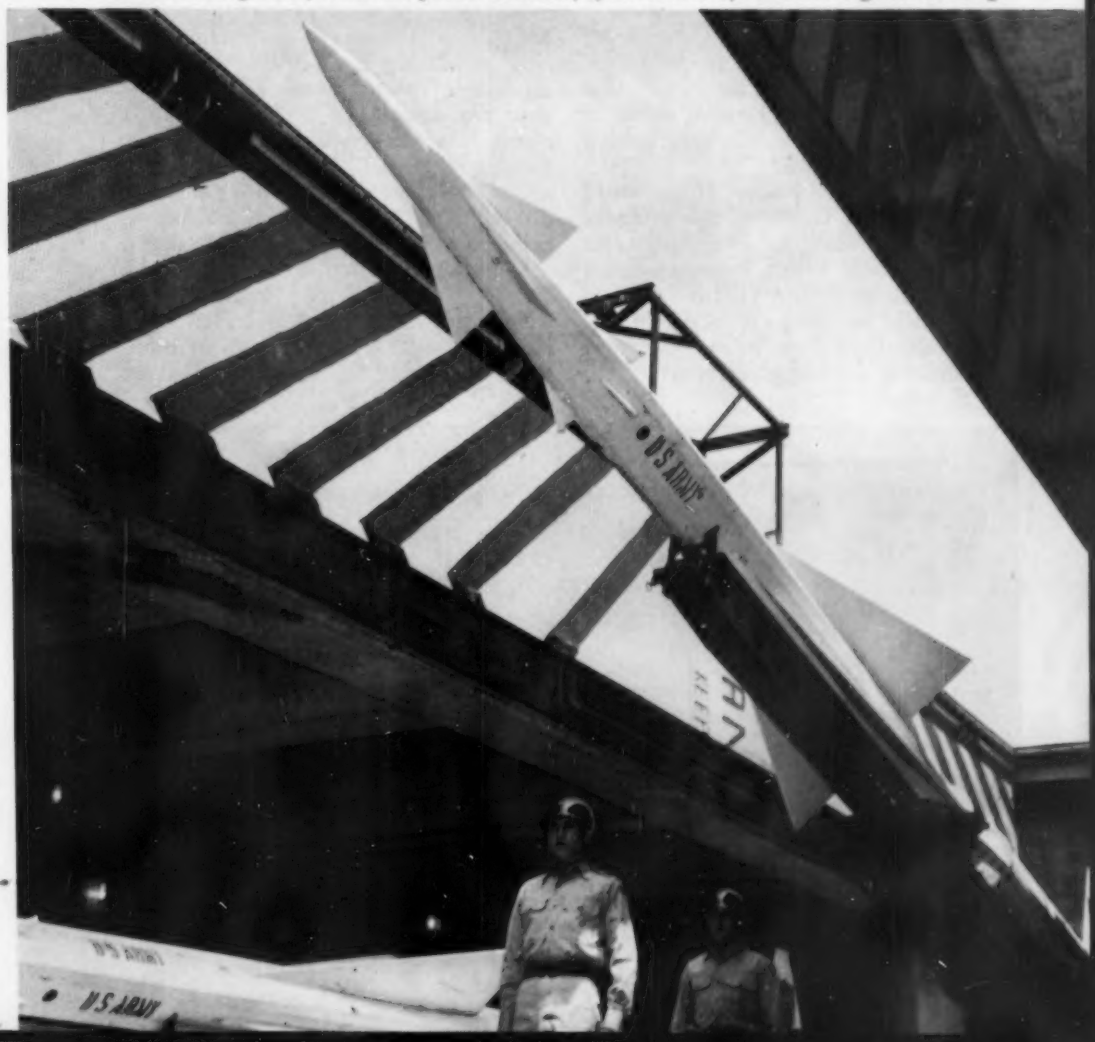
They are pure Buck Rogers. The push of a button can send a missile skyward toward a hostile airplane from any one of more than a hundred launching sites in the continental U. S. It can go more than 1,200 miles an hour. With single-minded purpose, it seeks out its own target.

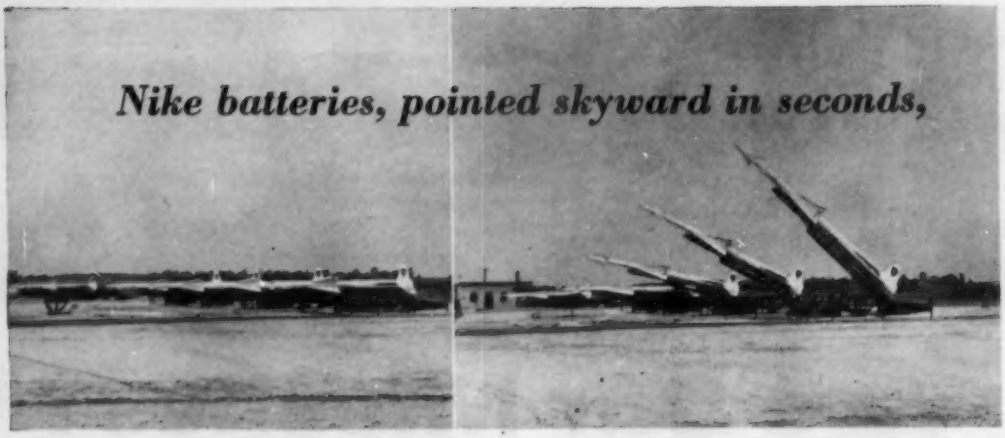
Other push-button missiles can be fired from airplanes or ships at ground, sea or air targets, and from the ground at ground targets. Missiles are being de-

Widely dispersed in continental U. S., antiaircraft Nike has "tremendous kill potential."

Are Our Missiles?

Stored underground, Nikes are put on launcher, sped to surface, reared 85 degrees for firing.





veloped to attack submarines far below the surface.

And, clothed in a secrecy as stringent as that enfolding the first atomic bomb, missiles are now in the laboratory that eventually will span an entire ocean or the Arctic regions at speeds approaching 10,000 miles an hour.

Vast destructive power. If the world ever again falls victim to the madness of a general war, the intercontinental ballistics missile, with a hydrogen-bomb warhead, could destroy civilized man.

More than two dozen types are in limited production for the Army, Navy and Air Force, or are being perfected.

Some are winged. These are not much more than pilotless, subsonic planes. Some, slim cylinders of destruction with only stabilizing fins, cleave the air at supersonic speeds. Some are ballistic—they are aimed like bullets, and their course is beyond control after launching. Some are "guided." They are target-conscious—they have mechanisms aboard to direct them toward their objectives. Some can be remote-controlled in flight.

Some are designed deliberately to be "stupid," some to be "smart." Some weigh only a hundred pounds. Some, ultimately, will scale hundreds *of thousands* of pounds. Some are propelled by

ONLY MASS-PRODUCTION MISSILE yet available to armed forces, Nike is assembled at firing site, this one at Lorton, Va., a few miles from Washington, D. C. Each of big steel cylinders contains a bird. This missile is economical of manpower—only six soldiers handle main launcher, three satellites. Storage requires humidity and temperature controls.

will protect 15 strategic areas

conventional jet engines, some by solid-fuel rockets, some by liquid-fuel rockets. Some have a range of only a dozen miles, some in excess of 5,000 miles. Most of them can tote an atomic explosive.

Each made for its job. Missiles differ for the same reason that guns and other weapons differ. The intercontinental ballistic missile (IBM), which currently bears the name Atlas, is meant to take the place of the piloted, long-range atomic bomber. The Falcon (PSM, May '55, p. 127) will supplement and perhaps eventually supplant the guns and rockets of the interceptor fighter. The Nike can be a replacement for the antiaircraft gun, the Honest John for the long-range artillery weapon, and the Regulus for the ship-based bomber.

To the soldier, sailor or airman, missiles are "birds." To the harried scientist, trying to find out why they often misbehave, they are "beasts." To the men in Washington's Pentagon, nerve center of the military, missiles are the "hardware" of a new age of armament.

A whole new dictionary of terms is growing up around missilry. The place on the trajectory where the engine or engines cut out is known as the "dump point." Interfering radio-control frequencies are "babble." Oscillation in a radar

MAIN PROPELLENT CHARGE consists of 18.8 gallons of nitric acid and seven gallons of kerosene, hosed aboard after assembly by soldiers clad in masks and impermeable neoprene suits.

WATER BATH is given a soldier who got some acid spilled on him. Launching area also has water source for emergencies. Ambulance with engine running stands by during fueling.

BUTTONS TO LAUNCH NIKES are pushed in van housing control room. This weapon, says Army, can outmaneuver and destroy "any type of aircraft presently known and foreseeable . . ."

is "beam jitter." A vertical surface added for lateral stability is a "skid fin." A cable attached to a missile with a quick-disconnect plug is an "umbilical cord." A jet-assist for take-off is a "booster."

In principle, missiles are simple. Each has a primary structure or air frame, control or stabilizing surfaces, a means of propulsion, and a warhead. The more sophisticated contain guidance devices—a "black box"—the nub of all the secrecy. Ask a missile man about guidance systems, and his mouth muscles harden.

While the push-button character of guidance systems makes the hair on the back of your neck crawl, they are not as exquisitely perfect yet as some of the clap-of-doom writers in the daily press would indicate. A look at how missiles are guided shows why.

The principles involved in guidance are common knowledge. Most guidance is, or is akin to, radio control. Guidance of a missile fired at a moving target, such as an airplane, generally is more complex than that for one fired against a fixed target. That's because its path must be corrected for target-path variations.

Best-known and simplest of the guidance systems used in missiles for the interception of moving targets is the "beam rider." The black box in this missile is intentionally moronic. A radar or other beam is shot at the target from a ground station or missile-launching aircraft. The missile follows the beam. It contains sensing equipment to detect deviations from this path. That's all it knows. It's far dumber than a dog or cat dropped out in the country in the vain hope that it won't find its way back.

Launching sites for Nike antiaircraft missiles are built, being built or planned for defense of these cities: Boston, Providence, Hartford, New York, Buffalo-Niagara Falls, Philadelphia, Washington-Baltimore, Richmond, Pittsburgh, Cleveland, Detroit, Chicago, Milwaukee, Los Angeles, and San Francisco.

A second means of guidance is known as the homing system. Missiles incorporating it have a high-school education. Reflecting the complexity of the art of missilry, there are several kinds of homing systems. One responds to disturbances made by the target itself, such as heat. A second will home on a target "illuminated" by radar from a ground station. A third will emit its own illumination on the target and home on that. All three apparently contain scanning devices, like a bloodhound's nose.

A third general means of guiding missiles against moving targets is known as the command system. Command missiles

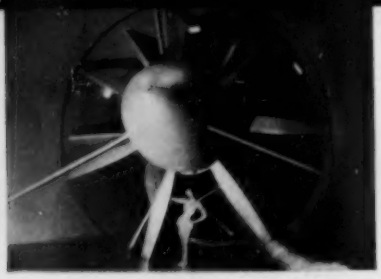
ONE RADAR SYSTEM "acquires" target. A second tracks it. A third tracks the missile. Combined information is fed to calculator, automatically radioing bird its flight path.

Most awesome of planned weapons is intercontinental ballistic missile with atomic warhead.

have gone, maybe, through the first two years of college. A guidance station tracks the target and tells the missile where to go, much as fighter planes were "vectored" toward hostile aircraft during World War II.

Firing guided missiles at fixed targets on the ground is not necessarily any simpler than making them collide with moving targets. Less is known, usually, about the whereabouts of ground targets. Two different guidance systems are used. One is intimately related to Loran navigation (PSM, Feb. '46, p. 78) and its twin, Shoran. It's called the baseline method. An artificial grid of lines representing distances from two signal-producing stations is laid down over the target. The missile—this one with a col-

[*Continued on page 218*]



HUGE SEVEN-BLADE FAN supplied wind to test truck shapes. Girl shows size.

New Shapes for Tested in

NOW they're streamlining trailer trucks. It's only experimental, but it may lead to some pretty weird truck shapes in the future.

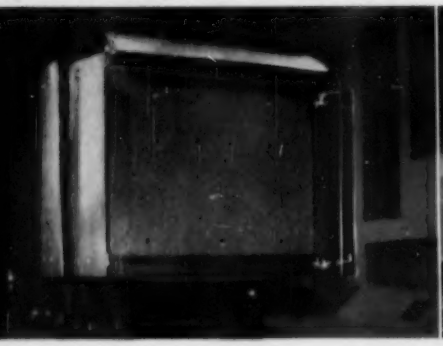
Streamlining cuts down wind resistance, which accounts for about a third of the horsepower needed to pull a big tractor-trailer at 50 miles an hour. Shaping a truck differently could result in fuel savings up to $375 a year. The experiments were conducted in the University of Maryland's subsonic wind tunnel, on more than 7,000 tractor-trailer combinations. Here are some of the results.

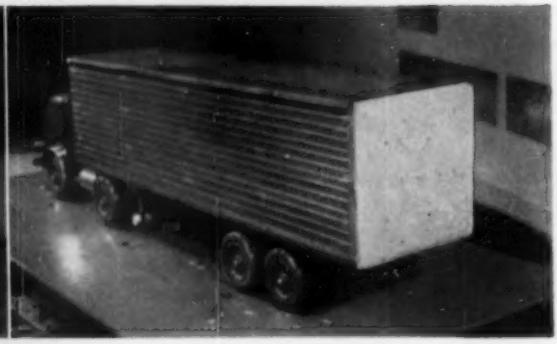
GUIDE VANES were used in one phase to deflect air and reduce drag. They proved useless. Experiments were sponsored by American Trucking Associations Foundation.

Drag with vanes was exactly the same.

REAR CORNERS were rounded on trailer in another effort to reduce drag. This helped little—"vacuum" in back was insignificant. Automatic equipment recorded wind resistance.

With rounded corners cost was 39.9 hp.



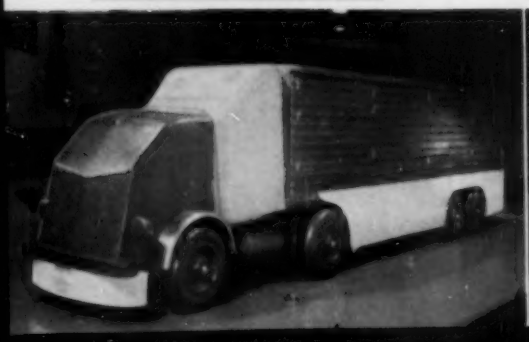


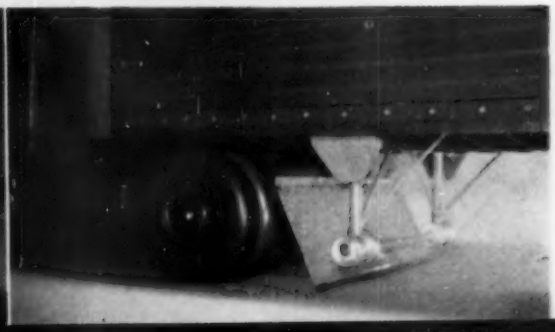
SEMI-STREAMLINING helped considerably. Big reduction in wind resistance resulted from rounding trailer's corners and roof on 18-inch radius. Skirts proved impractical.

Semi-streamlining cost 25.9 hp.

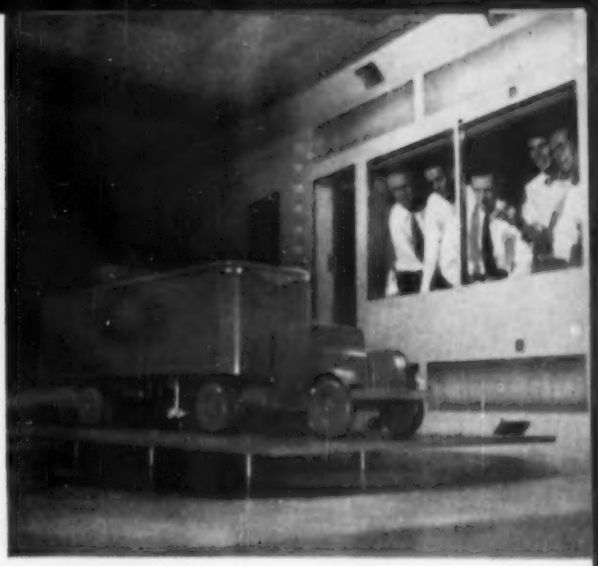
BIG FLAP mounted at rear of the tractor frame was tried in effort to reduce drag. But instead, it created additional resistance. Trailers with vertical posts also caught wind.

With it, cost was 42.2 hp.





Trucks Wind Tunnel

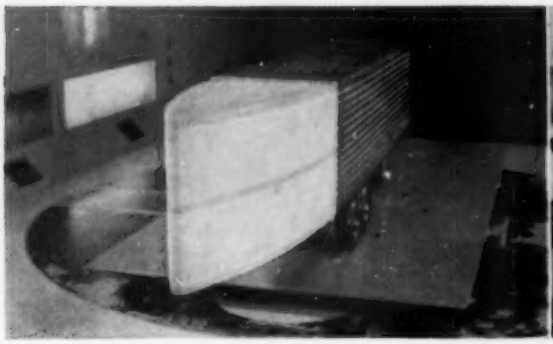


WOOD MODEL of tractor-trailer on one-sixth scale was mounted in wind tunnel under supervision of engineers. Panels below compare horsepower needed to overcome wind resistance at 50 m.p.h.

"BEAVER TAIL" reduced drag 12 percent, but extra length, necessary to preserve cargo space, made it impractical. University and Trailmobile, Inc., engineers conducted tests.

Without beaver tail, drag cost 41.3 hp.

With tail, drag cost 36.4 hp.



ADDING A "DROP" created a slight boost in drag. Models were made from full-scale blueprints to assure accurate readings. Wood used in building most components was mahogany.

Without drop, drag cost 41.3 hp.

With it, drag cost 42.5 hp.

FULLY STREAMLINED tractor-trailer approached ideal sought—drag was only one-fifth of that with conventional combinations. But laws governing length ruled it out.

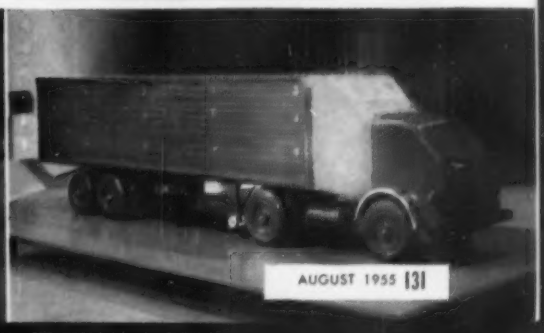
Conventional design cost 41.3 hp.

Complete streamlining cost only 8.1 hp.

FILLING GAP between cab and trailer proved to be the best all-around means of cutting air resistance. Only problem was how to hinge the two units. Design is now under study.

Conventional design cost 41.3 hp.

With gap filled, drag cost 31.4 hp.



SCENES IN FAIRYLAND. A pint-sized steamboat carries youngsters on a pond mirroring a fairyland castle in the Land of Make-Believe. This Adirondack play village was developed by Arto Monaco, seen at work on the facing page putting embellishing touches on the steamboat pilothouse. Below left, young visitors pose before the little church. At right, ponies match the scale of the stagecoach in front of county jail in Cactus Flats section of the village.

He Built a Play Town

Arto Monaco has scaled down a bit of the Wild West, fairyland, cars, wagons, trains and even a steamboat to fit the kiddies.

By Harry Walton

PLENTY of wood, paint and wallboard finds its way to Arto Monaco's workshop. But his most important material is not on lumber racks or supply shelves. It's the stuff dreams are made of, and Monaco has his own unlimited supply.

From it he has built a colorful, three-dimensional never-never land that children can stride through in the seven-league boots of imagination. His Land of Make-Believe, in Upper Jay, N.Y., is fantasy come to life. Everything in it—built in Monaco's workshop—is one-half to two-thirds scale.

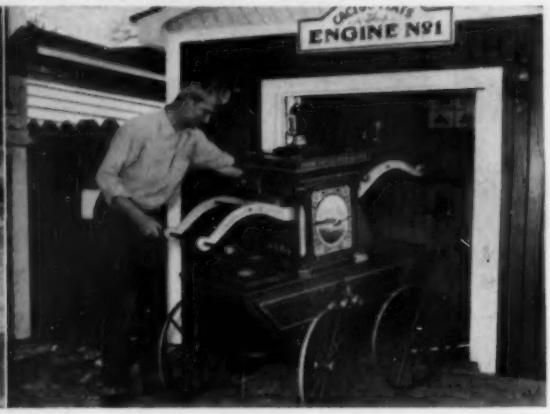
A double-barreled funland in the Adi-

IDEA DEPARMENT. New projects begin at Monaco's drawing board. Zany clocks make assorted noises and their hands move when kids wind them. Monaco designed the toys on shelf.

FREEWHEELING DESIGNER. Monaco doesn't freeze everything into blueprints. He creates details, as for this wacky clock, right at the power tool, sawing them to shape by eye.

PINT-SIZED FLIVVER runs when clutch lever tightens an idler pulley against the V belt. The clown is Monaco, whose idea of a day off is to don this outfit and give kids a laugh.

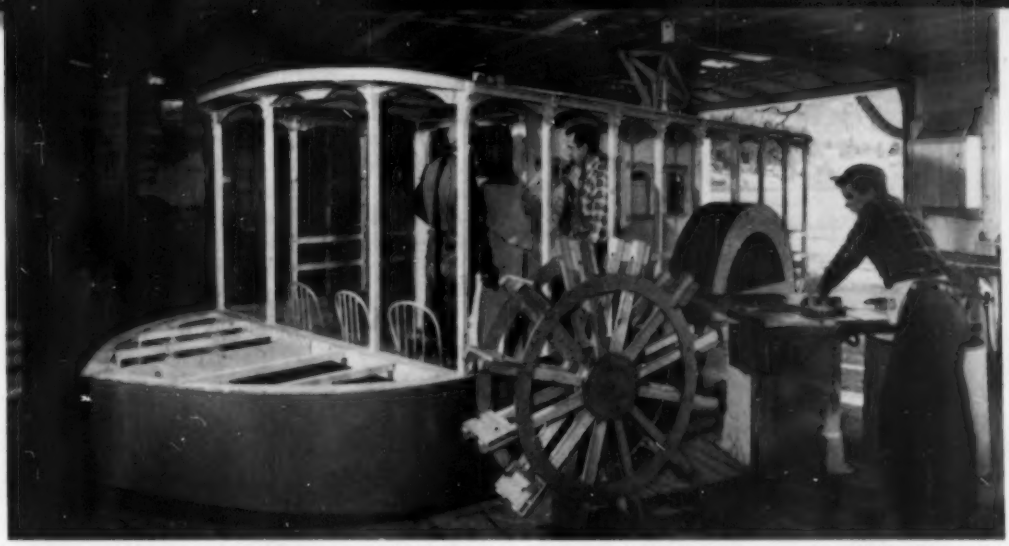
WHERE'S THE FIRE? This replica of an old pumping engine really works. William Calhoun, who did the decorative painting and lettering on this and the stagecoach, wheels the engine out.



rondack vacation country, it consists of two fascinating parts. One is Cactus Flats, as tough a Western frontier town as you'll find outside a Hollywood movie lot. It has a sheriff's office, county jail, firehouse, newspaper office, barber shop, general store, assay office, saloon and livery stable. Even the horses are scaled down—they're the right size to pull the Cactus Flats stagecoach. The saloon serves strong soda pop to bad men and good guys alike.

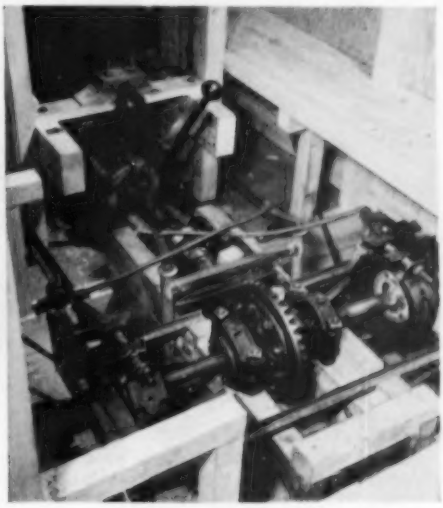
There are wood-plank sidewalks, lamp posts and street signs. The buildings are shore-'nuf real—but duck when you go through those doors, pardner! Furnishings are scaled down too, even to the cracker barrel and the potbellied stove in the general store.

Flight into fantasy. A few centuries away is the second part of Monaco's creation, Castletown, a fairyland village. Tots can wander into the home of the Three Bears as Goldilocks did, ring the



DWARF PADDLE-WHEELER was built inside the workshop. A V belt from a one-lung engine drives a large pulley, a sprocket chain-drives a slightly larger sprocket. From this, a hand-operated clutch drives an automobile differential (below) and two axles—one to each paddle wheel. A brake on each axle, linked to the pilot wheel, provides steering.

DUDES, COWPOKES AND GALS mingle on the realistic streets of Cactus Flats. Monaco has built a town you could shoot a Western movie in—if all your actors were midgets.



bell in the Little Red Schoolhouse, discover the candy house Hansel and Gretel found, explore the Fairy Tale Castle.

Small wonder that children feel the place is theirs. Instead of prohibitions, there are signs urging the little visitors to touch, sit in, wind up, ride on and otherwise make use of the exhibits. Anything they break goes back to Monaco's workshop for repairs.

In Cactus Flats, midget cowboys play barber, banker and printer, swagger down Kit Carson Street or Wild Bill Hickok Street, play the treadle organ in the saloon, and squirt water from the miniature pumping engine.

Transport is scaled down. With these settings, Monaco has combined miniature transportation—a live-steam railroad, a real stagecoach and a paddle-wheel boat. All but the locomotive (which burns coal and chuffs steam) were built in his shop.

There is also a midget flivver. Driven by a one-lung gas engine, it's geared so

YOUNG COWPOKE plays a working treadle organ for his girl friend, Peggy Calhoun. The sign on the wall urges children to touch and play with everything just as they please.

GO ON IN, GOLDILOCKS! Girls peek curiously into the home of the three bears. When they go inside, they'll find the three chairs and the three porridge bowls of the story.

low the smallest customers can safely drive it. Monaco hopes to find a Crosley he can rebuild into an antique car.

The *Billabong Belle*, a paddle-wheel boat 22 feet long, cruises the waters of the village pond. It has the wheelboxes, twin stacks, walking beam and pilothouse of the Mississippi River boats of Mark Twain's day. The scowlike hull draws only a few inches of water, but there's room for 20 passengers aboard.

Built in Monaco's workshop, the boat was prematurely launched last winter when ice jams backed up the river. Floes a foot and a half thick bulldozed the buildings off their foundations; water lifted the half-built boat off the floor. Monaco and his helpers shoveled out the mud, trucked off the ice and repaired the damage in time to open this season.

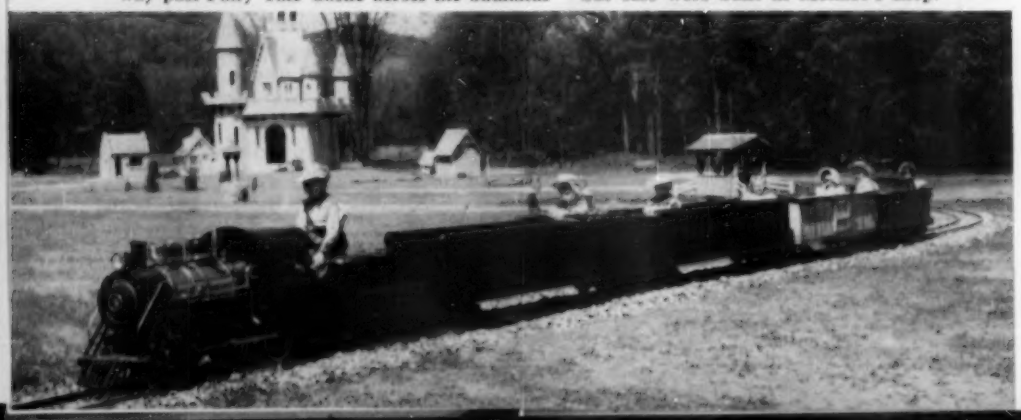
Artist via the Army. Born in the Adirondacks, Monaco was christened Arturo, but the name proved too much for the local recorder of births and was put down as Arto. Entering the Army in 1941, he was decorated in 1943 for his work in originating visual training charts and models. Discharged in 1945, he did a stint of animated-cartoon work in Hollywood and as a resort staff artist.

Returning to the Adirondacks, he opened a craft and gift shop there, making and selling hand-decorated trays, hope chests and similar craftwork. He also designed a successful line of circus and educational toys, but mass production couldn't hold his interest for long.

New dreams took shape on his drawing board and were translated into reality when he was commissioned to design

[*Continued on page 226*]

MIDGET COAL-BURNING LOCOMOTIVE puffs its way past Fairy Tale Castle across the badlands to Cactus Flats station. Engine was purchased, but cars were built in Monaco's shop.

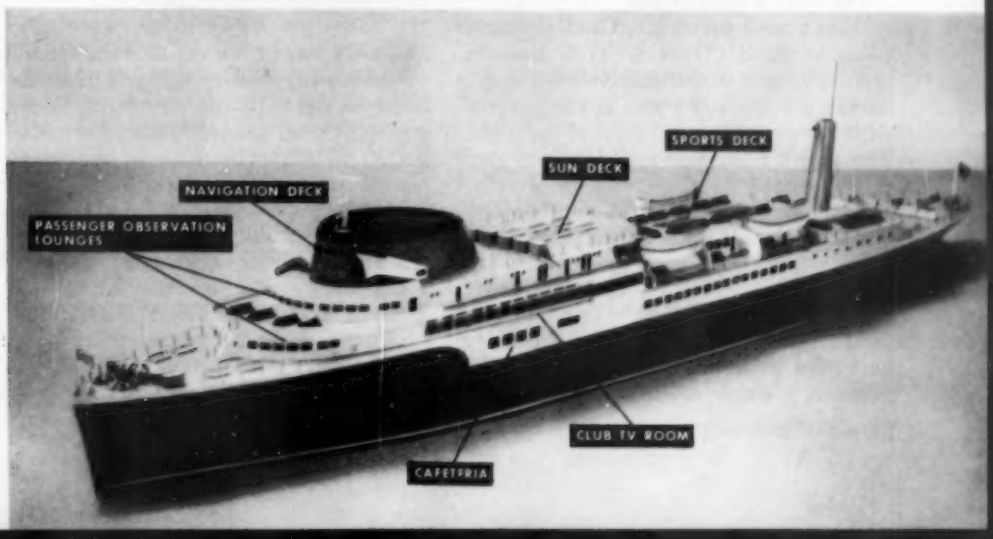


Electronic Shooting Gallery

THE curved walls of this huge chamber are composed of a small mountain of eight-foot timbers with only the butts showing. Over 8,000 of them, neatly stacked and backed by concrete walls 3½ feet thick, form the inner lining of an all-angle firing range at Evendale, Ohio. Here, Avco Manufacturing Corporation tests fire-control mechanisms for the tail guns of long-range bombers.

520-Foot Cruiser Will Cut a Luxurious Swath Across Great Lakes

THE new S. S. *Aquarama,* biggest liner on the Great Lakes, displaces 10,600 tons and towers seven stories above water. Spread through nine decks linked by escalators and elevators are accommodations for resting, feeding, entertaining and exercising 2,500 passengers. There's even a hanging stage between decks for bands.



Gus Slices Out of the Rough

By Martin Bunn

GUS WILSON, burly proprietor of the Model Garage, was awakened at five o'clock one Sunday morning by the persistent ringing of the telephone beside his bed. Sleepily, he lifted the receiver.

"My wife's having a baby," an excited voice said, "and I'm in a jam. Can you come right out?"

"Wrong number," Gus said wearily. "You need a doctor, mister, not a mechanic." He hung up and slid back under the covers.

"Brother!" he groaned. "Now they call me for babies."

The phone rang again.

"Don't hang up on me, Gus," the same voice pleaded. "This is Tom Bascom, groundskeeper at the golf club. My wife's having a baby and I was at the hospital with her yesterday and most of the night. The golf tournament is today, and part of the greens aren't—"

"Give me that phone, Bascom," an outraged voice cut in. "Gus Wilson, eh. Well, Wilson, if you don't get out here and fix this blasted mower I'll fire this nitwit, Bascom, baby and all!"

"Be right with you," said Gus, throwing back the covers and reaching for his pants in a single motion. He knew that young Bascom could not very well afford to lose his job at the club.

AS GUS swung his car into the circular driveway before the golf club tool house in the early-morning light, he was greeted by an unusual sight. Sam Abernathy, wealthy chairman of the greens committee, tastefully decked out in golfing attire, was heaving on the starter rope of an ancient, gasoline-driven mower. Tom Bascom, a slender, sad-faced young man, stood nervously by.

"Blast this confounded contraption," Abernathy roared in a voice that startled the sparrows in the trees.

"Morning, Tom," Gus said cheerfully.

"Pull, Mr. Abernathy," said Gus as Bascom ran for the clubhouse. Surprisingly, Abernathy pulled.

"Howdy, Mr. Abernathy—what's wrong?"

"What's wrong!" Abernathy bellowed. "The tournament starts in less than three hours, and this idiot, Bascom, is having a baby—I mean he hasn't mowed the putting greens around the sixth and seventh holes. As chairman of the greens committee, I would be utterly disgraced if . . . Drat it, man, get busy and fix this thing."

"Touchy engines in these old gadgets," Gus remarked, placing his tool kit beside the motor. "I wouldn't blame Tom."

"Not blame him!" Abernathy waved the starter rope excitedly. "Why hasn't he kept the greens in shape?"

"Ever have a baby, Mr. Abernathy?" Gus inquired as he unscrewed the spark plug from the engine and laid it on the cylinder head. "Sort of unnerves a man, they tell me."

GUS wound the starter rope around the pulley and yanked it. A fat spark jumped across the spark plug points. Gus rewound the rope and whirled the engine again, placing a thumb over the spark plug hole to test the strength of the compression produced.

"Don't piddle around, my good man," Abernathy said impatiently. "Get on with the job—and Bascom, if those putting greens aren't mowed as smooth as a baby's cheek by eight o'clock I'll—"

"Baby's cheek," Bascom said dreamily,

moving toward the clubhouse. "I've gotta phone the hospital and find out what's happened."

"Come back here, you idiot," Abernathy yelled after him, but Gus thrust the end of the starter rope into the chairman's hands and said, "Pull, Mr. Abernathy."

Surprisingly, Abernathy pulled. As the motor spun, Gus noticed that oil was being forced out the bearings of the horizontally hung main shaft ends. Crankcase breather stopped up, he thought.

"Fetch me a pan of gasoline, please," Gus said casually, as he knelt by the mower. "Got to clean out this breather."

"Fetch you a pan of . . . !" Abernathy echoed indignantly. "Look here, Wilson—drat it, what can be keeping that nincompoop Bascom?"

"Out of gas . . . mind giving it a little push?"

A grin came to Gus's leathery features as he broke out a rag and brush from his kit. The portly and dignified chairman of the greens committee had moved to draw gasoline from a drum into a drip pan.

"Thanks, old man," Gus said.

As a matter of principle, Gus cleaned the air filter as well as the breather pipe and breather screen, checked the gas tank for fuel. Not wanting to take the time to remove the plate covering the flywheel magneto and breaker points, Gus checked the timing by peering into the cylinder with a pencil light. The spark occurred close to top dead center, as it should. Satisfied, he replaced the plug, shut the choke, cracked the throttle and spun the motor. He couldn't get a pop out of the mower engine.

TOM BASCOM now appeared again. "The doctor told me," he said worriedly, "that my wife and baby would be all right—but how do I *know?* Maybe I'd better go to them."

"Of course she'll be all right!" Abernathy exploded. "Go to the hospital? Not on your life. Get your mind on your job, man."

"Tom," Gus asked, "how long will it take you to get those putting greens mowed?"

"A couple of hours at least," Tom said. "And it's nearly six o'clock now."

"Maybe," Gus told him, "you'd better get another mower, and let me take this one to my shop—might save time."

"Another mower!" Abernathy broke in. "Don't you know it's Sunday, with everything closed up? Besides, I doubt if there is another mower in town that could handle this job. I pay Bascom to keep these greens in shape, and by Harry I'll have his hide if—hey, where do you think you're going, Bascom?"

"Sorry," Bascom mumbled as he ran toward the clubhouse. "Better phone again."

"There are some things, Mr. Abernathy," Gus said dryly, "that you can't buy, on Sunday or any day. Now about this motor. I'll do my best to fix it without taking it in to my shop."

"All right, all right," Abernathy said plaintively. "But hurry."

"When a man gets in too much of a hurry," Gus said, digging out his pipe, "his brains take a vacation."

NEVERTHELESS, he told himself, I'd better get a move on and get this contraption popping before Abernathy's golfers show up and begin belting rabbits out of the tall grass around those putting greens. Now I know I've got a good spark here, timed about right. If I've also got a gas mixture, I'm bound to have an explosion—so, I haven't got a good gas mixture.

Thinking about this, it dawned on Gus that when he cranked the motor with the choke closed, it didn't have the wheezy

[*Continued on page 216*]

What You Can Do with Flex Wheels

Mounted on a table saw or other tool, these revolving abrasives will cut just about everything.

By Darrell Huff

MY KIDS wanted a portable barbecue for picnics, and I figured that a five-gallon paint can had the makings of one. That's how I met flex wheels.

These are thin disks, the size of a saw blade, that look like cardboard but aren't. They're made of such things as glass-fiber cloth impregnated with resins and hard abrasives. Mounted on a table saw or on portable tools, they'll cut and grind materials you never dreamed of working so easily—heavy metals, pipe, stone, concrete—jobs that would wear your arm off with a hacksaw or chisel or wouldn't be possible at all.

My dealer steered me to a type of

HERE'S THE PICNIC GRILL that I made from a five-gallon paint can. An aluminum-oxide wheel on my table saw quickly sliced the can lengthwise just past center so that the handle was left on for carrying the grill. I also used the disk to cut pipe legs that screw into flanges bolted to the can.

wheel designed specially for metals when I told him about my paint-can cooker. It sure did a quick job of slicing that steel drum in two.

Ever since, that $2 wheel—along with a few others for different uses—has been a lifesaver around my shop and home. And when I say lifesaver, I mean it literally, too. The beauty of flex wheels is that they won't shatter, showering you with high-speed lethal fragments, as the rigid type can do if accidentally mistreated in inexperienced hands.

You can twist them, bind them, jam them, and the worst that can happen is a ruined disk. You have to be sure, though, to wear goggles to protect your eyes from flying sparks and particles.

What wheel to use? Unlike saw blades, there are only two basic types of abrasive flex wheels, so it isn't too hard to keep track of them. One is aluminum oxide, which is used on metals, especially the hard ones like iron, steel, hard brass and hard bronze.

The other is silicon carbide for use on nonmetallic materials, such as stone, concrete, brick, tile, plastics, asbestos-cement board, plasterboard, carbon, brake linings and insulation boards. This

YOU CAN SEE THE PROBLEM I HAD tiling this round-ended counter top. With a silicon-carbide wheel for nonmetallics, I sawed the ceramic tiles to size, then ground the edges to a smooth curve against the side of the disk.

SHARPENING TOOLS IS EASY if you use the side of an abrasive wheel. Use a coarse grit for shaping and removing nicks, finish up with a fine grit for smoothing and polishing—and you'll wind up with an excellent cutting edge.

ON AN ELECTRIC DRILL, a flex wheel gives you a portable hacksaw and grinder you can take anywhere. Here I'm lopping off rivet heads with a coarse-grit disk to get at one of those mechanisms they make impossible to open.

YOU CAN SLICE THROUGH STONE by making several passes, raising the wheel each time, until you're through. For rough cuts, you can score stone lightly, then break along line. I cut the stone to build a patio fireplace.

type will also do a good job on the softer metals, and is sometimes recommended for cutting steel in the form of small-diameter rods.

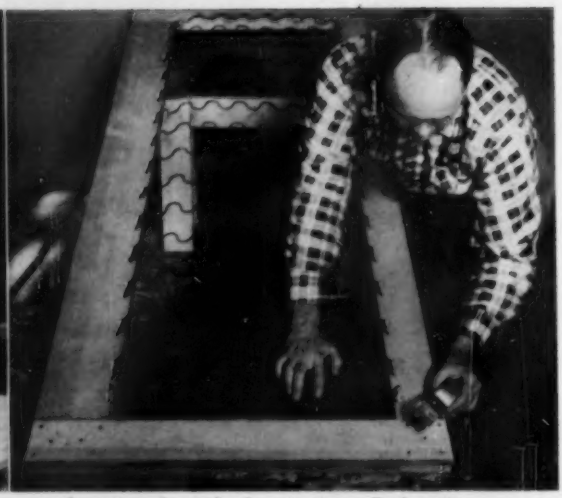
Incidentally, I once had a devil of a time cutting some heavy steel angle until I discovered that I was using the wrong wheel—the one recommended for nonmetallic materials. So you do have to be careful to get the right type of wheel for the job. When in doubt, always check the label on the side.

Both types of abrasive come in various degrees of grit, depending on whether you're after fast cutting or a smooth finish. For most jobs, you'll need only two grades, coarse and fine.

One manufacturer suggests 24 grit for cutting and grinding, 36 grit for finishing. Another company offers "coarse" wheels for cutting, grinding and sharpening tools, "fine" for final smoothing.

When you come to choose a wheel, you'll find that some are quite flexible, as their name implies. Others seem fairly rigid, but are reinforced against shattering and, if they are so labeled, are safe on home equipment.

How to use them. For most home-shop jobs you can have a full selection of



NASTIEST STUFF I KNOW TO CUT is this zigger wire you use for springs. It's so hard that it dulls hacksaw blades and files. Unrolling a length at a time, I just zipped it through a metal-cutting flex wheel, snipping off the 15 pieces needed for this couch spring. In working with a flex wheel, keep your hands away. The disk may bark your knuckles.

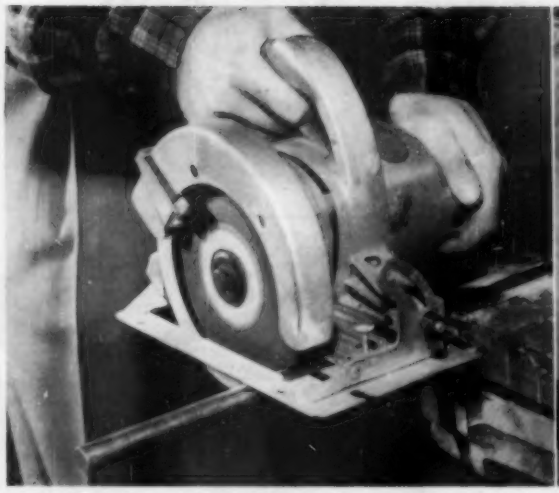
MOUNT A THIN DISK on an ordinary grinder or sander, and you can use both edge and face of the wheel to cut intricate shapes in metal. Use tool guard and always wear goggles.

INEXPENSIVE ARBORS let you chuck a disk on a flexible shaft, as here, in a drill press, or mount one directly on a motor shaft. Wheels come with center holes to fit any tool.

abrasive wheels with only four kinds—coarse and fine aluminum oxide for metals and coarse and fine silicon carbide for other materials. That's a total investment of $8 to $10 to cut anything that a woodworking blade won't handle.

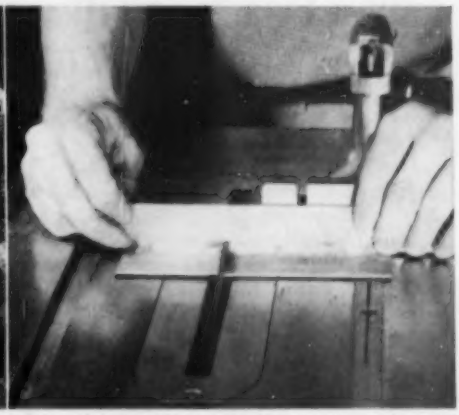
You mount a flex wheel on your saw just as if it were a regular blade, except that the sides should be stiffened with flanges covering at least one-third the diameter of the wheel. Some disks also call for special cushioning pads. These are little blotters that come with the wheels.

Don't be too gentle or timid about the way you feed the wheel—it won't bite by itself, so you will have to help it. Keep the work pressing against it steadily and evenly all the time. Remember, too, that an abrasive wheel cuts on its side as well as its edge. Try to keep the work as straight as possible or the disk may snow-



ON A PORTABLE SAW, abrasive disks cut both metallic and other materials as easily as on a table saw. Reinforced wheel at left slices heavy steel rod. You can feed it at a good husky pressure, but use both hands where possible to steady it. If a masonry block is too thick for a single cut (right), you can score around sides and it will break cleanly.

BIG PLASTIC SHEETS, like these corrugated structural panels, are slow to hand-cut and death on saw teeth. A silicon-carbide wheel trims them quickly without dulling or wear.

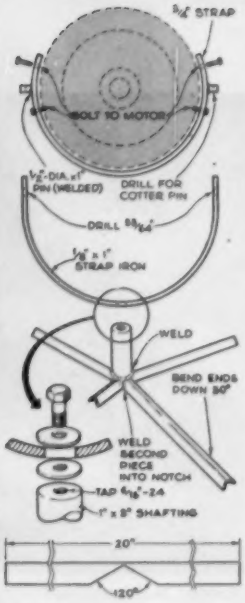


TRY THIS ON YOUR HACKSAW if you're still not convinced of what a wheel will do. I later broke several high-speed drills trying to get screw holes through this heavy angle.

plow a bit, cutting a wide and sloppy groove.

You can use a flex wheel in any tool that turns at a safe speed. The maximum speeds recommended for flex wheels are nearly always marked right on the disk and usually run between 4,500 and 7,000 r.p.m. You won't have to bother much about this, since the average shop saw turns at about 3,450 r.p.m., well below the safe limit. Other electrical motors use either that speed or 1,725 r.p.m. Portable drills vary, but hardly ever exceed 2,500 r.p.m.

I have a friend who needed to dig out a 35′ trench in his concrete basement floor in order to bury a fuel line. He mounted a flex wheel in his 8″ portable saw, cut a pair of slots about 1¾″ deep, and chiseled out the concrete in between. One silicon-carbide wheel lasted for the whole job. END



Tilt Mount Lets Motor Follow Flexible Shaft

THIS floor stand for a big flexible-shaft motor lets it both turn and tilt to follow the business end.

Notch a 20″ length of ¾″ angle iron widely enough at the center to leave an opening, when its ends are bent down, for a similar crosspiece. Tap a hole in a piece of 1″ shafting and weld this on top.

If your motor has a base or mounting plate bolted to it, remove this and shape the swivel clamp to fit the bolt holes. Otherwise, tap holes in the motor housing for bolts to hold this part.

From heavy flat stock, make a U-shaped swivel bracket. Drill it for the tilt pins and a swivel bolt. This should be long enough to jam by bottoming in the hole, while leaving the bracket loose enough to swivel.

By cutting and fitting parts first, you can do all welding at one time.—*Phil McCafferty, Stanwood, Iowa.*

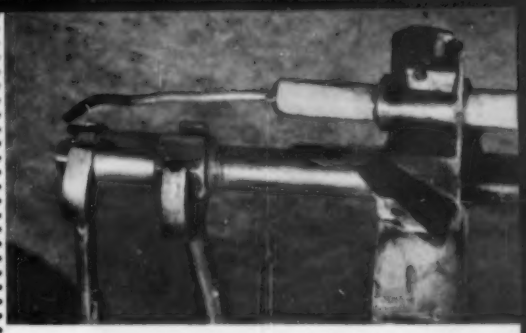
SPRING THE BRACKET enough to slip the motor into it and insert swivel pins in their holes. A cotter pin in each pin secures it.

Fold Your Own Burner Manual

THAT oil-eating gadget in the basement need be no mystery to you. It's basically simpler than an auto engine. Cleaning and adjusting a gun-type oil burner is easier than putting a new set of points in a car.

Because this is information you should keep on hand constantly, PSM here presents another first—a service article printed so that you can fold it into a compact little booklet that is easy to save and handy to have.

Cut out the next two pages along the thick black line. Fold the top half of each page down behind the bottom half. Next, fold each in half lengthwise. Interleave the two folded pages to bring the figure numbers in correct order, and cut across the top folds as in the photo above. Presto! A fact-crammed little booklet you can hang alongside your furnace or put into your POPULAR SCIENCE MONTHLY Shop Data File.



5 **REMOVE SCREWS** holding the igniter assembly in place, and draw it out. In this burner, it is mounted below a plate carrying the transformer on top. Brush soot off the insulators, electrodes and air vanes.

6 **USE TWO WRENCHES** to remove the nozzle assembly, taking care not to hit the electrodes or fragile porcelain insulators. Holding removal nut, unscrew front one (counterclockwise, seen from the end).

22 **OIL THE MOTOR,** using only three or four drops of light engine oil such as SAE 10. Do this every six months. Oil motor on hot-air blower or water circulator the same way.

23 **OPEN OIL VALVES** and turn on main switch. Turning thermostat up should start burner. Observe flame, adjust air. On this burner, lever controls it, on others a slotted segment held by setscrew. Flame should have orange tips without smoke. Smoky flame soots furnace, needs more air. Too much air causes white flame, wastes oil.

FIRST: CUT OUT ALONG THIS LINE

SECOND: FOLD HERE AWAY FROM YOU (THIS SHEET ONLY)

THIRD: FOLD HERE AWAY FROM YOU

What to Do if the Burner Quits

SHOULD the burner fail during the heating season, first make sure that nobody has cut the main switch by mistake and that the thermostat is set high enough above room temperature to call for heat. Then follow this trouble-shooting list:

1 Check oil supply in tank. Don't trust the gauge; use a dip stick.

2 Check burner fuses. If blown, replace only with identical ones. Should motor hum but not run, shut it off immediately and call a serviceman.

3 Press reset lever or button on stack control (Fig. 24). If burner starts but shuts off after about 90 seconds, stack element may be dirty. Shut off main switch and clean the element (Fig. 2).

4 Clean thermostat points (Fig. 1). Set thermostat to highest reading. Should furnace run but not fire, turn off main switch immediately. If there is a strong odor of unburned oil, clean and adjust igniter assembly before trying again.

5 If there is no oil odor after burner runs without firing, or if it fires but sputters out or burns raggedly, shut it off and clean the nozzle (Fig. 7).

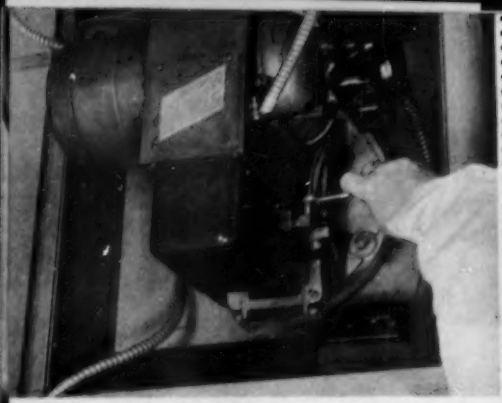
6 If burner does not fire after nozzle is cleaned, remove plug from bellows chamber and hit switch to check for air lock (Fig. 25). If no oil appears, the line or strainer is plugged or the pump badly worn, damaged or not turning.

7 Disconnect the oil line from the igniter assembly and hold a container under it. Turn on switch momentarily. If no oil appears, the bellows is probably broken.

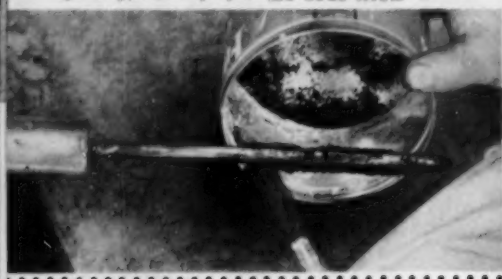
If all these checks fail, or indicate damaged parts, call a serviceman.

How to Service Your Oil Burner

BEFORE touching the burner, shut off the main switch. Then follow the steps in the numbered photos (turn page for Fig. 1). Your burner may have the parts differently arranged, but all gun-type units have similar components.



4 CLOSE VALVES in oil line. Disconnect oil line running to igniter assembly. (On some burners it may be underneath.)

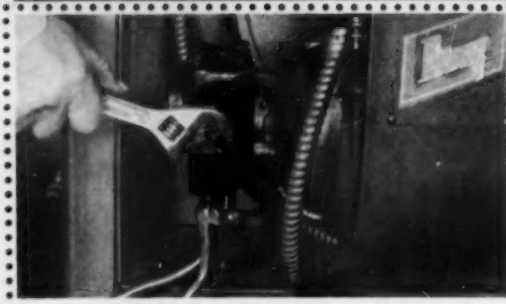


3 CLEAN SOOT OFF stack element with a soft brush (accumulation may hold switch open, stopping burner soon after it starts). Replace stack element and tighten screw.

24 IF BURNER DOES NOT START, make sure fuses are good, switch is on and thermostat calls for heat. Then press and release button on stack control. If this does not start burner, call a serviceman. (Burner can be stopped any time by pressing same button, but will start again after recycling unless the thermostat is turned down or the main switch shut off.)

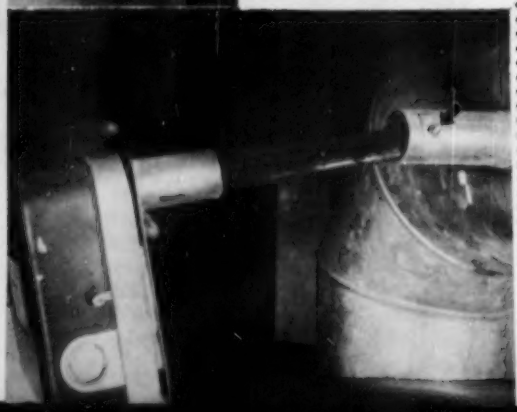
1 SET THERMOSTAT to its lowest reading. Remove the cover. With a soft brush, clean both sets of contacts (tips of the two screws and the tiny inset disks opposite them).

2 SHUT OFF main switch. Locate stack-control box on the smokepipe or furnace. Loosen the setscrew (arrow) and pull the stack element straight out with a twisting motion.



25 IF MOTOR RUNS with no flame or oil odor, or flame goes out but motor keeps running, there may be an air lock. Shut off motor. Remove plug in side of pressure chamber. Switch motor on until oil flows out; then quickly shut off motor and replace plug. If no oil appears, line or strainer is plugged, or the pump is worn or damaged.

26 CLEAN OR REPLACE air filters in hot-air systems. Shake out or use a vacuum cleaner to remove loose particles of dirt.



13 TO TEST IGNITION and condition of insulators, connect primary transformer terminals directly to 115-volt line and place disconnected oil line in can and turn on switch. A steady spark should hop the gap. If spark appears elsewhere, install new insulators.

14 BEFORE REPLACING the igniter assembly, use a clean brush to clean the blower fan. Also see whether there is any oil in the fire-box. If so, it indicates a worn shutoff valve. This should be replaced by a serviceman.

15 BEFORE TRYING to remove the strainer for cleaning, be sure to identify its cap. On this burner, it bears the letter S. Other cap covers the bellows chamber. It should not be removed. Make a sketch of the cap markings so you can replace it same way.

16 TAKE OUT the screws that hold the strainer cap. Set them, the cap and its gasket carefully aside on a piece of clean paper. Then lift out the large spring and draw out the strainer assembly as below.

FIFTH: FOLD HERE AWAY FROM YOU (THIS SHEET ONLY)

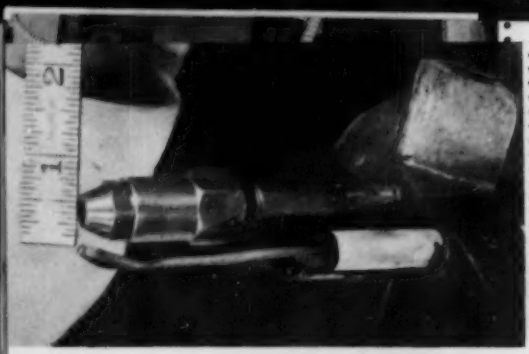
FOURTH: CUT OUT ALONG THIS LINE

7 REMOVE THE NOZZLE. Unscrew screen from inside with fingers. Then hold nozzle with wrench, and with a clean screwdriver carefully unscrew the slotted member inside (a scratch is likely to ruin it).

8 CLEAN SCREEN AND NOZZLE parts in lacquer thinner or hot running water. Do not wipe dry; lint will clog passages. Air-dry or install wet. If parts show signs of burning, replace the entire nozzle assembly.

SIXTH: FOLD HERE AWAY FROM YOU AND NEST IN FIRST SECTION

21 UNSCREW THE BOWL of the oil filter, clean it, and install new element. Be sure bowl gasket is intact and connections are tight.

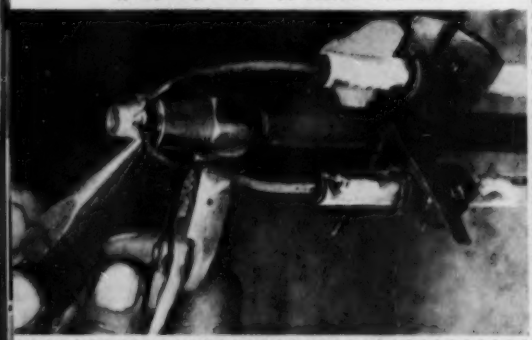


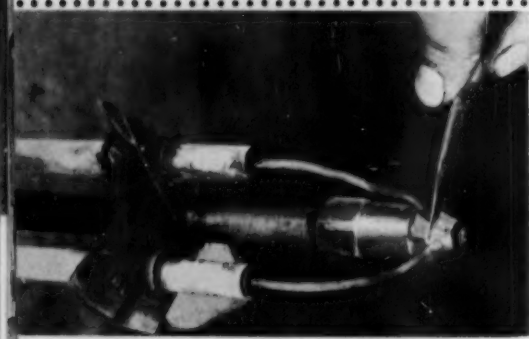
11 **USE TWO PLIERS** like this, when bending electrode ends for adjusting the gap, to avoid putting strain on insulators.

12 **TIPS SHOULD REACH** to end of nozzle, not beyond, and should be 3/8" above or to one side, out of line of the oil spray. To adjust lengthwise, loosen clamps and slide insulators in them.

17 **WASH THE STRAINER** in lacquer thinner, gasoline or hot water. If it is very dirty, disassemble and clean its parts separately.

18 **BY LOOSENING NUT** on bottom of this strainer assembly, its elements can be pulled apart as shown. Lay them on paper and wash one at a time to keep them in the same order.





9 **SCRAPE CARBON** off electrode tips with a pointed knife blade or sandpaper. If you have already cleaned and reassembled the nozzle, keep scrapings off by wrapping some clean paper around it.

10 **CHECK THE GAP** between the tips. Reset them to the manufacturer's specifications (1/8" is the average setting).

19 **REPLACE STRAINER** and set gasket back exactly as it came off. If it is cracked or otherwise even slightly damaged, replace it.

20 **SET CAP BACK** in its original position. To draw it up firmly without strain, first tighten opposite screws, then the other two.

By Art Margolis

The Case of the TV Rasters

Why did the cop blow his whistle? The TV serviceman didn't know, but the answer came as a welcome surprise.

WEAVING my TV service truck through traffic one morning, I was stopped short by a police whistle. A tall cop strolled to the rear of the truck, where the license plate is, and began to write. Then he waved me on before I could ask him what I had done.

I had stopped worrying by the time I punched the doorbell for my last call that afternoon. Then who opened the door but the ticket-wielding gendarme!

Courageously putting aside plots of revenge, I looked at his TV, a 17-incher. The sound was perfect, but the picture was scrunched up, only an inch wide, making the actors look like very tall and very skinny sardines. Raster trouble.

Raster is a TV gobbledygook word for the pattern of horizontal bright lines you can see on your screen when there is no picture. Your set makes the raster to provide a framework for the picture received through the air.

The raster is created by a narrow beam of electrons that the back end of the picture tube shoots at the screen. The electrons make the screen glow where they hit. To create the full picture, the beam is swung over the screen like a pencil.

The swinging is done by two electromagnets around the neck of the tube. One magnet makes the beam move back and forth—horizontal sweep—while the other magnet pulls the beam up and down—vertical sweep.

On the policeman's TV the horizontal sweep looked cockeyed, so I checked the electromagnets. I found broken insulation, letting the horizontal magnet short through to the vertical. A simple replacement put the raster back into shape.

Then I turned to the large arm of the

law and asked, "I'm curious about one thing. What did I do this morning to rate a ticket?"

He looked startled. "Ticket? Gosh, fella, I didn't give you a ticket. I just wanted your phone number off the truck!"

That's the closest a raster ever came to giving me law trouble, but the things are always a source of TV trouble. A couple of case histories from my files may help you diagnose similar upsets in your own receiver.

The Emergency

IT TAKES a grade-A emergency to get me on a service call after quitting time. I dashed out one evening after such a call suggesting a flame-swept receiver or an imploded picture tube.

A six-year-old boy led me to the TV —a 16-inch set that was obviously no immediate hazard to life or limb.

Still, the picture was a mess. It showed nothing but thinly spaced jagged horizontal lines. And I could hear chirping that sounded like a wounded sparrow. Hardly an emergency. Just raster trouble: a horizontal oscillator off frequency.

A raster is a delicate creation, calculated in millionths of a second. For a good picture, the magnets must sweep the electron beam across the screen exactly 525 times line by line and do that 30 times every second. This means the horizontal magnet's strength—set by the voltage supplied it—has to change 15,750 times (525 by 30) every second. The horizontal sweep circuit is supposed to do that, feeding the magnet a voltage of 15,750-cycle frequency (in the audible range). If the frequency is wrong, the picture breaks up into jagged black and white lines, just what I found on this set. A close look revealed a broken resistor.

I was packing my gear when in came the young homeowners, dressed for a ball. I was sore about that emergency gimmick and said so. "If you're going out, why insist on service tonight?"

The husband replied, "If it was for us, we would have waited. But I have to go to my boss's tonight, and we can't get a baby sitter without TV."

Damper Dirty Work

I WAS kneeling before an old 12-incher trying to make sense out of its weird picture. In the background I seemed to hear words from the lady of the house, a dark-haired young mother: "Would you mind if I ran to the market? If little Albert cries give him this bottle."

By the time the meaning got through to me, she was gone, and little Albert was cooing at the mixed-up TV image.

There was a big black gap on the left side. The right side was pulled out like

a sheet of taffy and folded back on itself. This is extreme horizontal foldover and usually means dirty work in the horizontal-sweep oscillator.

This circuit has to make current that, besides oscillating at precisely 15,750 cycles, must oscillate in a very special manner. On an oscilloscope it is a wave shaped like the edge of a crosscut saw.

The sawtooth wave makes the magnets move the electron beams so fast they

cause shock waves that distort the sawtooth unless they are absorbed by a damper. In this veteran receiver, the damper tube had died in action. I replaced it and a proper raster appeared.

Confronted with a normal picture, little Albert began to scream. I stuck the bottle in his mouth as Mama returned.

She smiled. "I see the television is fixed and you're feeding little Albert. Did you have much trouble?"

"Nothing much, but I had to change the damper," I said.

She looked pleased. "Well, I think that's very nice of you—and I'm glad you were able to find the diapers."

Diversionary Tools

IN A corner of my tube caddy I carry Special Tools. You won't find them in any electronics catalogue, but sometimes they are handier than a screwdriver.

Take the case of the new 21-incher. These folks were plying me with coffee, candy, cigarettes. I had to be pleasant. But their collie kept licking my neck.

Out came Special Tool No. 1—a large rubber dog bone—and Fido was happy.

The picture had collapsed into a thin, bright, white line straight across the screen—no vertical sweep.

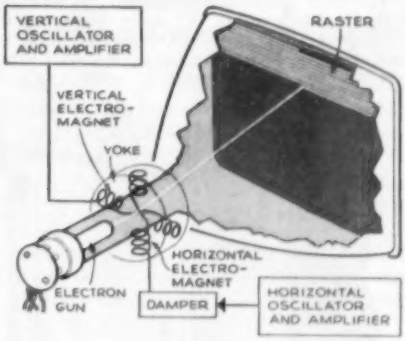
You remember that the vertical electromagnet must pull the electron beam up and down at the same time the horizontal electromagnet moves the beam sideways. To vary the vertical magnet's strength for this job, there is a vertical sweep circuit. Its output oscillates 60 times a second, just the right speed to pull the beam up and down so that each line is drawn one beneath another.

In this set, the vertical circuit had died and the 525 horizontal lines of the picture were being drawn on top of each other in the middle of the screen. I turned the brightness down immediately, for this heavy electron bombardment on a small phospor space would burn a permanent trace on the screen.

When I turned to my toolbox, there was the four-year-old playing blocks with some five-dollar tubes. So I tried Special Tool No. 2—a large plastic monkey wrench. That fixed Junior.

I also fixed the set rather easily. A condenser had shorted. But when I poked the soldering gun into the TV, the husband latched onto my shoulder. I outwitted him with Special Tool No. 3.

When I was ready to leave I pried the dog bone away from Fido, wheedled back the plastic wrench and took from reluctant hands the latest issue of POPULAR SCIENCE MONTHLY. END



The raster is a pattern of close bright lines upon which the picture is built. It is made by an electron beam that creates a tiny spot of light where it hits the screen. The spot moves faster than the eye across the screen, then down, then across again and again for the full pattern of 525 lines 30 times each second. The beam traces every odd line first, then goes back and fills in (this reduces flicker). Two electromagnets on the tube neck move the beam—one for vertical motion, one for horizontal.

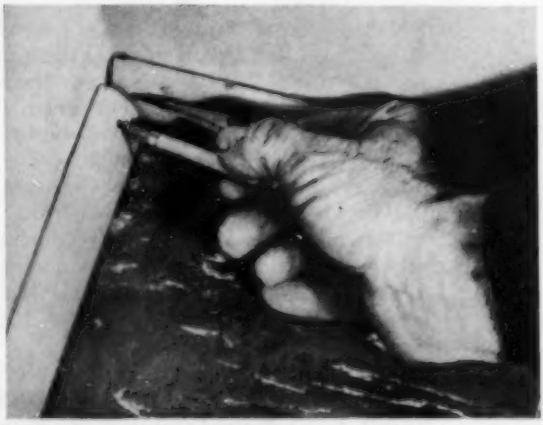
6 USES FOR A Compass

FIFTY cents invested in the tool shown at left can save you time, trouble and wasted stock on dozens of fitting jobs around the home. Variously called "pencil dividers," "pencil compass" or "scriber," the tool is handy and accurate. It is also much more convenient than the ordinary dividers sometimes pressed into service for similar jobs. A wing nut locks the spread setting.—*Edwin M. Love.*

1 TO FIT A SHELF against plaster, set and lock the tool legs about ¼" apart. Propping the oversize shelf on its cleat, draw the final cut with the legs perpendicular to the wall. Then split the pencil line carefully with a jigsaw.

2 MATCHING A CORNER, quite difficult by trial and error, is easy. Note the tool is at a 45° angle to the wall, to allow for the amount the shelf will slide in after trimming. If only one side needs trimming, hold at 90°.

4 CABINETS usually have extra stock at the back to provide for careful fitting. Hold the cabinet temporarily, shimming it plumb, and then scribe the line of cut. Even new plaster walls are often irregular or slanting.



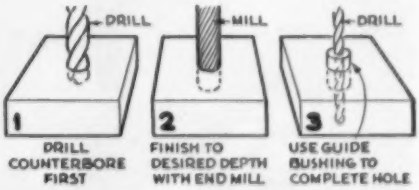
5 QUARTER-ROUND JUNCTURES can be a headache to fit neatly if you try to make a conventional miter. An easy out is to cut the end of one strip to match the contour of the other. This also works with other types of molding.

3 WHERE A PANEL meets an adjoining plaster wall, temporarily mount it plumb but as close as possible to the plaster. Scribe it from the adjoining wall. A well-fitted edge often looks better than one masked by molding.

6 CHAIR TEETERS can be licked with this handy gadget, too. Be sure the floor is level, set the tool at the short leg, and then reproduce the line at the other three as a cutting guide. Set the tool with the pencil leg short, of course.

Plow Teeth Prove Hardness

NOT a saw, but a plowshare—and proof of the effectiveness of hard-surfacing. Electrically hard-surfaced in 1″ sections, 3″ apart, a plowshare is shown above after plowing 10 acres of sandy soil. Untreated sections wore down, hard-surfaced parts stood up. Lincoln Electric Company, Cleveland, makers of hard-surfacing electrodes, estimates that full-length treatment of plowshares can increase their normal life five times.



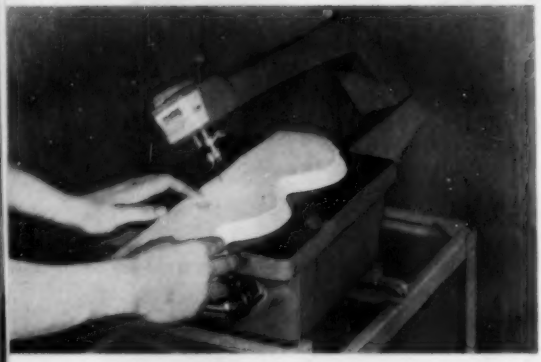
Here's a Counterbore Trick

LACKING standard pilot-guide counterbores or in need of a special size, you can do the job accurately with a bushing. Drill a shallow hole the diameter needed for the counterbore, and finish to the required depth with an end mill to produce a flat bottom. Then make a guide bushing from scrap rod and insert it in the counterbore to center and guide the smaller-diameter drill through the workpiece, completing the counterbored hole. —*J. E. Cushman, Stonington, Conn.*

Hang Tools with Cut Nails

INSTEAD of drilling press-fit holes for steel dowel pins on which to hang wrenches or accessories on machines or metal stands, you can use cut shingle nails to support them.

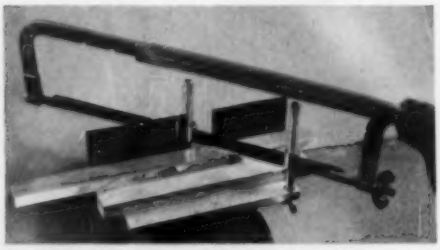
These nails, slightly rectangular, are tapered so they will hold in a pilot hole of about the same diameter as the tip. Just drive them in lightly until they hold.—*John A. Blaker, Auburn, Mass.*



1. Jigsaw Has Tilting Arbor. You can make intricate cuts at any angle and in any direction at the same time on the tilting-arbor jigsaw at the left without the blade creeping or wandering.

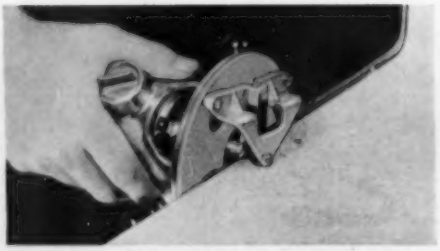
The table remains flat, while the entire motor, yoke and blade assembly swings to any angle up to 45° in either direction. It will cut wood stock up to 2″ thick, metal sheet, plastics, leather, etc., with the same blade. The throat has a depth of 20″, and the blade can be rotated 90° for ripping long lengths against a fence.

New Tools



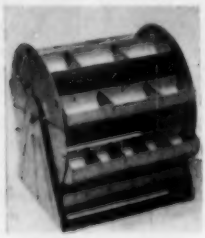
2. Miter Box for Metal. By mounting a hacksaw in this adjustable miter guide, you can make accurate angle cuts in aluminum and other metals. The blade is guided by two spring-retained slotted collars that slip down over the top edge. The tool will cut stock up to 1¾″ thick and 2″ wide and can be clamped in a vise or mounted on a bench.

3. Tools Ground on Table Saw. With a grinding wheel in a table saw and this jig clamped to the rip fence, you can put perfect edges on most cutting tools. The guide screws into various combinations of holes, giving the correct grinding angles for plane and jointer blades, wood and cold chisels, drills and other tools. It can be set for either straight or hollow grinding.



5. Router Guide Trims Counter Tops. Attach this sliding guide to your router and you can run it along the edge of a counter to trim the covering. The guide has an off-center collar that can be rotated to vary cutting height. A special dual bit with both straight and angled sides lets you make either square or beveled cuts.

4. Trays Roll Out Small Parts. These revolving trays, pivoted like seats on a Ferris wheel, make it easy to see and reach screws, bolts and other small hardware. The bracket can be mounted on a bench or wall and has a friction adjustment that keeps heavy parts from revolving to the bottom.



Further information about the products described on this page can be obtained from: 1. Syncro Corp., 605 Lapeer Rd., Oxford, Mich.; 2 and 3. Riverside Enterprises, 114 Riverside, Corning, N. Y.; 4. Peters Mfg. Co., Thomas St., Kawkawlin, Mich.; 5. Stanley Electric Tools Division, 195 Lake St., New Britain, Conn.

His Shop Was for the Birds

Cramped for space to use your tools? You might do as this man did—turn a prefab henhouse into a home workshop.

By Phil McCafferty

THE chick who hatched this project was two-year-old Sheila.

When my brother Bud's little girl toddled into the living room dragging a saw with one tiny fist and a hammer with the other, nothing could make his wife Dorothy consider the situation the least bit humorous.

"I appreciate all the things you've made for the house," she said, "and I am happy that you enjoy making things. But you've got to find a better place to work. I stumble over your jigsaw every time I enter the closet, and you certainly aren't going to build that duckboat under my feet in this kitchen. Look, just look what your daughter has! Where did she find those tools—in your toolbox behind the refrigerator?"

Here was a situation Bud had been pondering a long time. The house was small—built before they had a family. No

START OF BOAT he couldn't build in kitchen is held by Bud McCafferty in finished shop.

INTERCOM SYSTEM links the McCafferty shop and home. This was a gift from the missus.

space in it for a shop. The basement-shop angle was out—no basement. The garage was out too; it takes a sardine canner's skill to get the car in there and still get the door closed.

"You like to build; why don't you build a shop?" his wife asked.

The thought stuck. Maybe he *could* build one. An addition to the house or garage? Maybe it would be nice to have a separate building where he could make all the noise necessary, as late at night as he cared to work, and still not wake the baby.

Calling in a carpenter friend, he pinned down approximate costs. An addition on the house, he was told, would cost some $1,000—if he did it himself maybe $500 to $600. A little less was predicted for a garage extension. "Gosh," he thought, "that's more dough than I can afford."

"But why," tipped the carpenter, "don't you look into precut buildings if you are thinking of a separate shop?"

Kicking that thought around, he made a tour of lumberyards the next day. Precut garages 22′ long cost around $500, plus foundation. Still a lot of dough. Doing some mental backing down, he thought: "This shop doesn't have to be fancy—just a place to work, that's all."

Then came the dawn. Driving past the next establishment on lumberyard row, a huge sign beckoned, "Farmers—Precut Chicken Houses—Complete $139."

He stopped in. The salesman, after asking my red-faced brother how many chickens he had in his flock, gave the details of the building.* It had a 10′-by-14′ floor and three windows. Even though the roof slanted back to a 5′ rear wall, the building was 8′ high in front. That would allow a 6′ man to stand upright in all but the rear 3′.

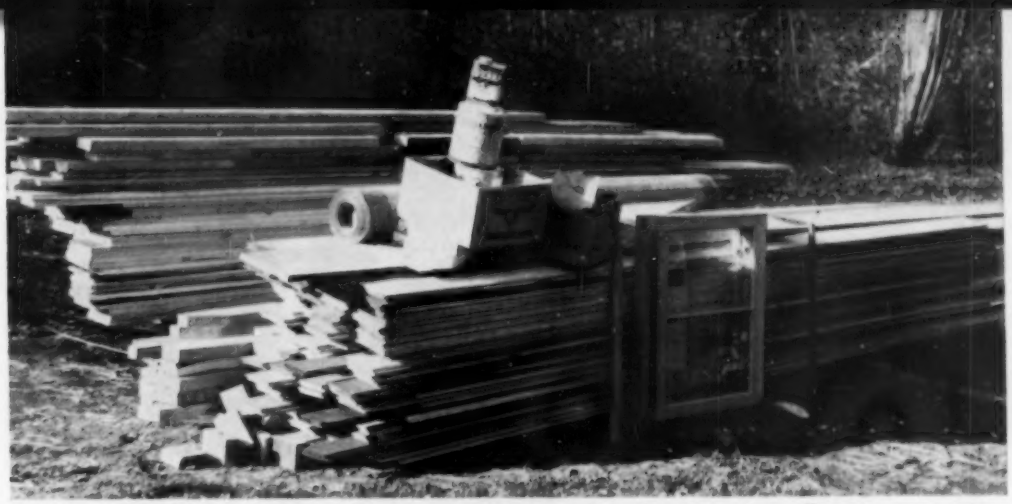
This was beginning to sound like the very thing he needed. They would deliver it for the price complete. That included nails, paint, roofing material—everything, down to instructions for putting it together.

A clincher does it. What really put the deal over was a pile of two-by-threes and one-by-fours. "These," the salesman said, "are the roosts."

"Roosts? What'll I do with roosts in a shop?" Then the lights really brightened. "Roosts, heck," Bud thought, "that material will make shelves and benches!"

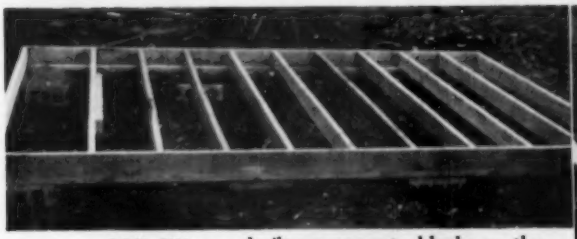
Driving home, my brother tried to figure how he was going to rationalize the spending of 139 bucks to his wife. Before he reached the house he had it figured. He'd tell her he was giving up that fishing trip he was saving for; then before she could make a comeback, he'd tell her that upon completion of his shop, he would make the lawn furniture she

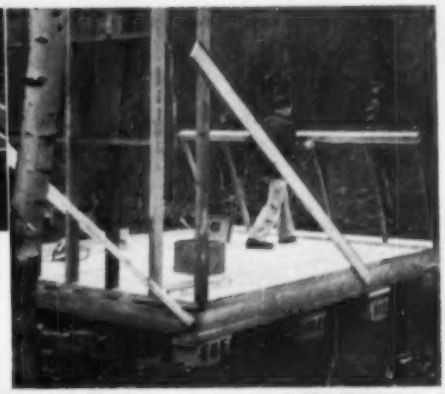
**Precut chicken houses generally similar to this one—bought in Yakima, Wash.—are available at many lumberyards throughout the country. Prices may vary. If the yard doesn't have the material in kit form, the operator may be willing to cut it for you according to your plan.*



PRECUT HENHOUSE KIT delivered from lumberyard waits in McCafferty back yard for beginning of construction. All parts were cut to size except siding, flooring and roofing.

How the henhouse workshop was built





BOX SILL was built on concrete blocks as the first step. Then floor joists and tongue-and-groove flooring were nailed in place.

STUDDING AND PLATES were assembled flat on floor, raised and nailed in place with temporary bracing. Rafters were the next step.

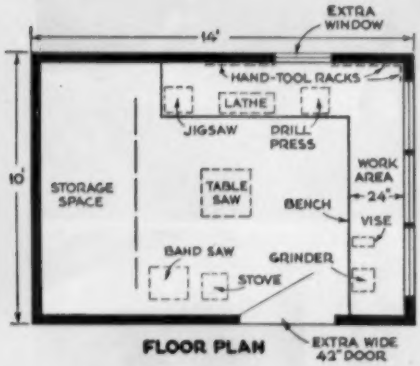
STENCILED MARKS showing location of each part in the assembly were helpful to amateur builder. Mortised bracings provide extra strength.

BUILDING PAPER was stapled on the studs before siding was applied so shop would be weathertight. Mrs. McCafferty, interested, helped here.

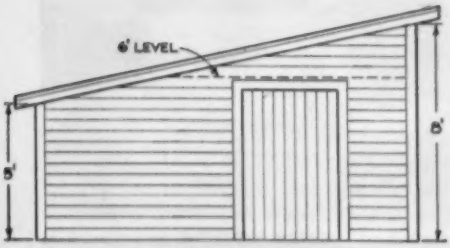
EXTRA WINDOW was placed in one side of shop for additional light. Casing was simple because windows were installed to hinge up on the inside.

ROOST MATERIAL in henhouse kit makes workbench framing. Little Sheila, who inspired new building, calls it "da-de chickie shop."

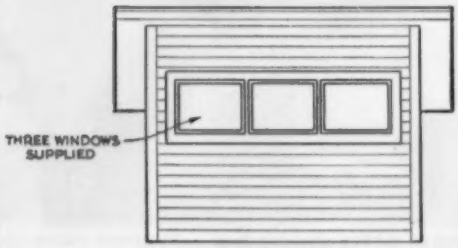
SOLID BENCH TOPS were made from rough slab lumber. Application of tempered hardboard with 6-penny nails gave smooth work surface.



FLOOR PLAN



SIDE ELEVATION



FRONT ELEVATION

had been asking for. His plan worked.

Next evening when Bud came home from work, the pile of lumber was in his yard. He examined the yard for a spot to erect his shop, figuring the foundation would be a pretty small investment. The site was firm and rocky, so he leveled eight concrete blocks on the ground and built the box sill on these. When more time and money permit, he plans to make a more durable concrete foundation.

Wife gets in on act. Construction, with the help of his wife, went along smoothly. Most of the parts were precut to exact size. The only sawing required was on the tongue-and-groove flooring and drop siding. He figures it took him about 25 hours, working evenings and weekends, to close in the shop. Then he wired the place and put in a used oil burner to enable him to finish the interior at night.

The only changes he made to effect the transition from chicken house to home workshop were to put in an extra hinged window and make the door one upright stud wider—it came to 42″.

As he planned, he made the 24″-wide benches around the end and one side of the shop with the roost material.

The low end of the shop gave him a place for storage. Lumber, garden tools, lawn mower, hose and similar items took up this space.

Total cost when finished was $180. This included lumber for bench tops, hardboard, wiring, stove, extra window—everything.

Birthday surprise. Even though his wife was happy to know he wouldn't be building his boat on her kitchen floor, she got in the last word. You see he had a birthday about the time the shop was going up. What did he get from his wife for a gift? You guessed it—an intercom outfit to connect the house and the shop!

When he made the trip carrying the jigsaw from the closet to the newly completed shop, Dorothy held the kitchen door open. As he passed through he smiled and said, "Well, it's finished, and I like it. But if things get tough—we can always raise chickens." END

ALMANAC
FOR MOTORISTS

Pithy proverbs, provident counsel and omens and portents of interest to horseless-carriage operators.

▶▶**Heroic treatment,** when an engine overheats on a highway where you can't find a spot to stop and let it cool, is to turn on the heater. The extra radiation area may help, though it won't add to your comfort.

▶▶**On a long trip,** clean off that insect cemetery on the windshield at dusk if you plan any night driving. Glass that's adequately clear by day is a danger when headlights from oncoming cars pick up the insect smears.

▶▶**Cars that are even just a little oil-hungry** around town often become enormously greedy oil-gulpers when they are driven fast. Moral: on a long trip, watch the dipstick closely—you can need oil before you need to fill up the gas tank.

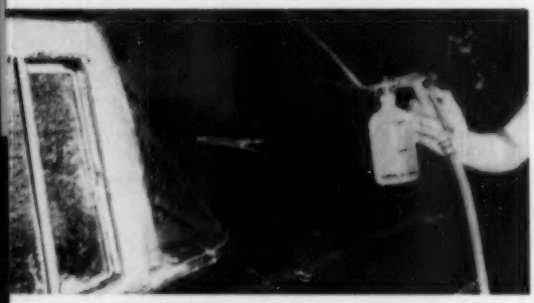
▶▶**How long since** you washed that air cleaner on the carburetor? Maybe you remember the last tibe you had a code in the doze? Stop-ups in the filter are similar. A regularly cleaned, re-oiled filter not only saves you gas but spares wear and tear.

▶▶**It's usually easy** to Tom-Sawyer a youngster into washing the family car. Certain flourishes of the chamois, plus the enticements of the hose stream, generally will do the trick. Sometimes a buck reward helps, too.

New for Your Car

1. Car Bumps Door Open. Nudged by the car bumper, a protruding latch actuates a new low-cost automatic garage-door control. When the latch is released, two springs attached to the pull ropes of overhead door roll it upward out of the way.

2. Cooler Mounts in Window. This blower-type cooler plugs into the lighter socket and can be placed in any window. The maker says it keeps a steady stream of air coming in regardless of driving speed. It comes in six- and 12-volt models.



3. Spray Bottle Takes Detergent. Attached to a garden hose, this spray unit can be used to dispense detergent when you wash the car. It's also useful for insecticides. Made of Bakelite polyethylene, the container is marked for ounce measurement.

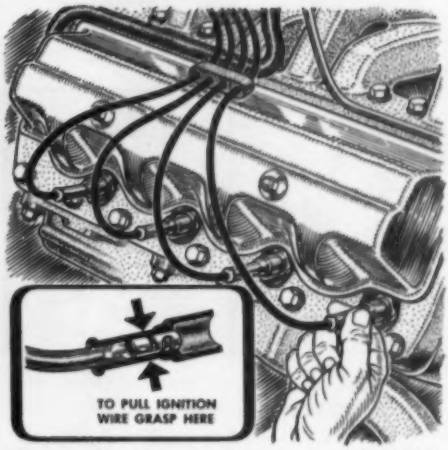
Further information about the products described on this page can be obtained from: 1. C.T.S., Inc., 7020 Euclid Ave., Cleveland 3; 2. Bonzer-Western Corp., 3055 E. 12th St., Los Angeles 23; 3. Gilmour Mfg. Co., Somerset, Pa.; 4. Coffee Car-Bar Co., Box 116, Northbrook, Ill.; 5. Super Seal Products Co., 1235 35th Ave., Oakland 1, Calif.

4. Coffee While You Drive. Plugged into the lighter socket, this dashboard unit heats water for instant coffee. Lock-cap plastic containers store sugar, coffee, tea, powdered cream and enough water for three cups of coffee. The aluminum heating unit also holds a coffee mug.

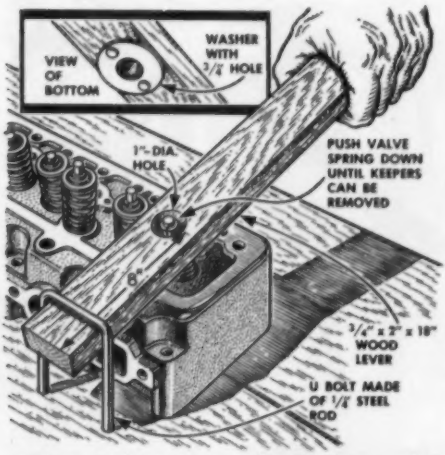
5. It Seals Windshield Leaks. A mastic is now packaged in a squeezable tube for sealing windshields. A tapered tip puts sealant into the space between the glass and rubber molding without mess. The maker claims that even a child can do it, and presents this photo as proof.

Hints FROM THE MODEL GARAGE

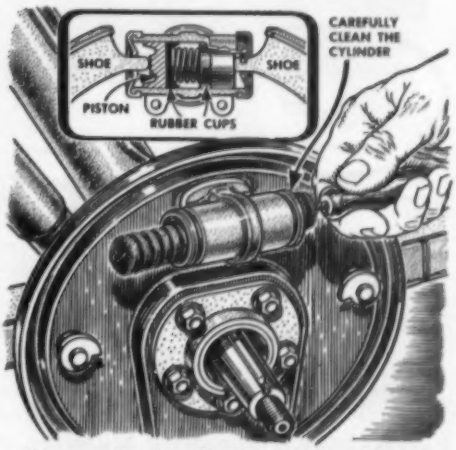
Save your fingernails by using last winter's plastic ice scraper to remove vacation stickers and resort advertisements accumulated on your car during the summer. A clean rag dipped in solvent or dry-cleaner fluid will remove any pieces missed by the scraper.



When cleaning or changing spark plugs, owners of Plymouth V-8s should pull the ignition wires by grasping them only at the reinforced section near the plug. Pulling on the wire might cause an internal break resulting in misfiring or weak spark.



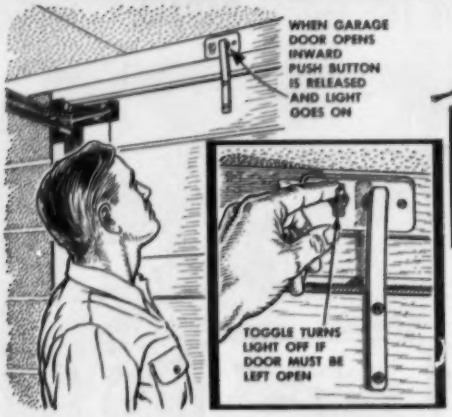
Valve springs on overhead-valve engines can be compressed and held safely while the keepers are removed by using a piece of hardwood as a lever. Place the head on a heavy board and fasten a U bolt in position behind it. Shift the head after each spring is removed to align the next valve with the U bolt. Reverse procedure to install valves.

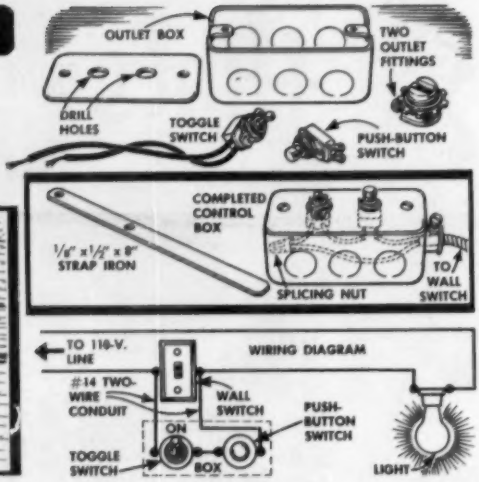


Clean wheel cylinders thoroughly when installing new brake linings. The full thickness of the new lining will push the cups deeper into the cylinder, and gum or dirt on this long-unused part of the wall may cause the cylinder to leak. Be sure to use only hydraulic-brake cleaning fluid, and allow to dry before reassembling parts.

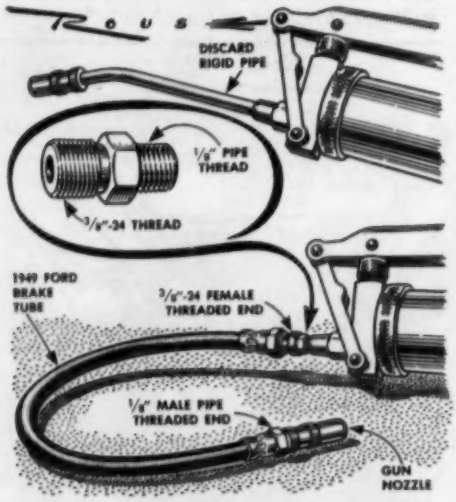
Please turn the page for more auto hints

MORE Hints from the Model Garage

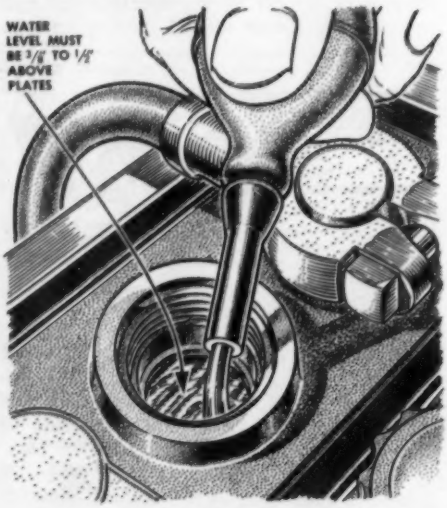




The light goes on automatically when you open a garage door equipped with this setup—just as in a refrigerator. Close the door and it goes out. A normally closed, spring push-button switch operated by a strap-iron finger on the door does the trick. A length of two-wire armored cable links the automatic control box to the wall switch box in an out-and-back circuit. Connections in the wall switch box are made at the switch-terminal screws. Remove a knockout plug to admit the wires and clamp them to the box.



A grease gun will reach all fittings with ease if you replace the rigid-nozzle tube with a '49 Ford flexible brake line. Attach the line to the gun with a tube fitting having a ⅛" pipe thread on one end and a ⅜"-24 thread on the other. Screw the original grease-gun nozzle on the male ⅛" pipe thread on the free end of the brake line.

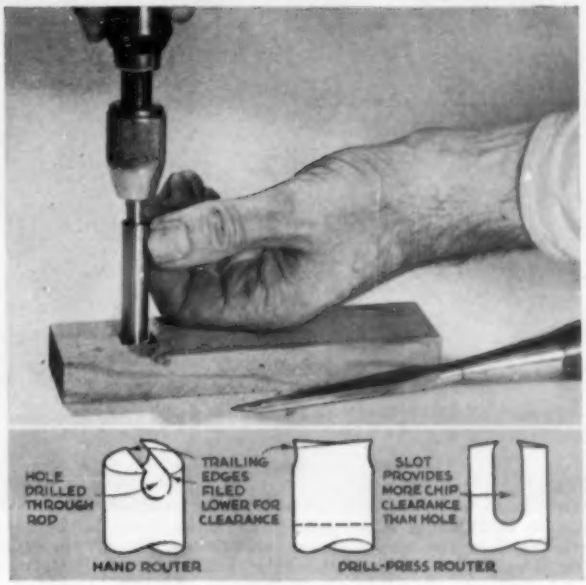


Check your battery water more often than usual during the hot late-summer days. The water evaporates faster in the excessive heat and can drop below the top of the plates in a week's time, drying them out and reducing output. Maintain the water level ⅜" to ½" above the plates, but don't overfill as it will bubble out of the vents.

Homemade Drill-Rod Bit Routs by Hand or in Drill Press

Used by hand, this bit works more like a rotary chisel than a router. But the result is the same—a smooth finish at the bottom of hinge recesses or deep recesses where a chisel is hard to work with. The bit can be used in a drill press, too, like a regular router bit for surfacing or grooving.

To make it, use a 3″ length of drill rod of the diameter best suited to the job. Drill a hole about half the diameter of the rod close to one end. Cut the end to expose the hole and file the edges to form the opposing angles shown in the drawing. Turn the other end to a ¾″ shoulder to fit in a hand drill or hand chuck.—*Walter E. Burton, Akron, Ohio.*



Gearshift Knobs Hold Files

Those elongated plastic knobs used on gearshift levers make neat handles for small and medium-size files. They are available in auto-supply stores. Wrap the file tang with adhesive tape and turn it tightly into the threaded insert in the knob.—*Ken Murray, Colon, Mich.*

What's Going on Here, Anyway?

It's an odds-on bet that you can't guess what's happening in the peculiar tableau at left, which took place recently in the back yard of PSM Associate Editor Henry B. Comstock. Some hints: it is *not* the funeral of a favorite parakeet, nor any other pet; it is *not* the rapt silence while Plume-head tries to play "Carnival of Venice" without hitting a clinker; and the whole clan is *not* off its rocker.

Give up? **Turn the page for the answer.**

TOOLING UPGRADE with a 400-lb. boulder, the newly built barrow could always be sure of a small-fry escort—because the kids counted on the free ride back. That year the wheelbarrow helped build a 100′ walk-topped stone wall. It stayed sturdy and solid.

Home-Built Wheelbarrow

After years of patching rickety load toters, this man built one. It's going strong a decade later.

THAT scene on the previous page was the tenth birthday of Old Indestructo, a super-sturdy wheelbarrow that Henry Comstock made after two store-bought ones went to pieces. A man who tends to build stone walls for amusement, he thinks nothing of trundling 500 pounds of fieldstone down a rough path at semi-runaway velocities, which is abusive treatment for ordinary barrows. He resolved to build one that could take it.

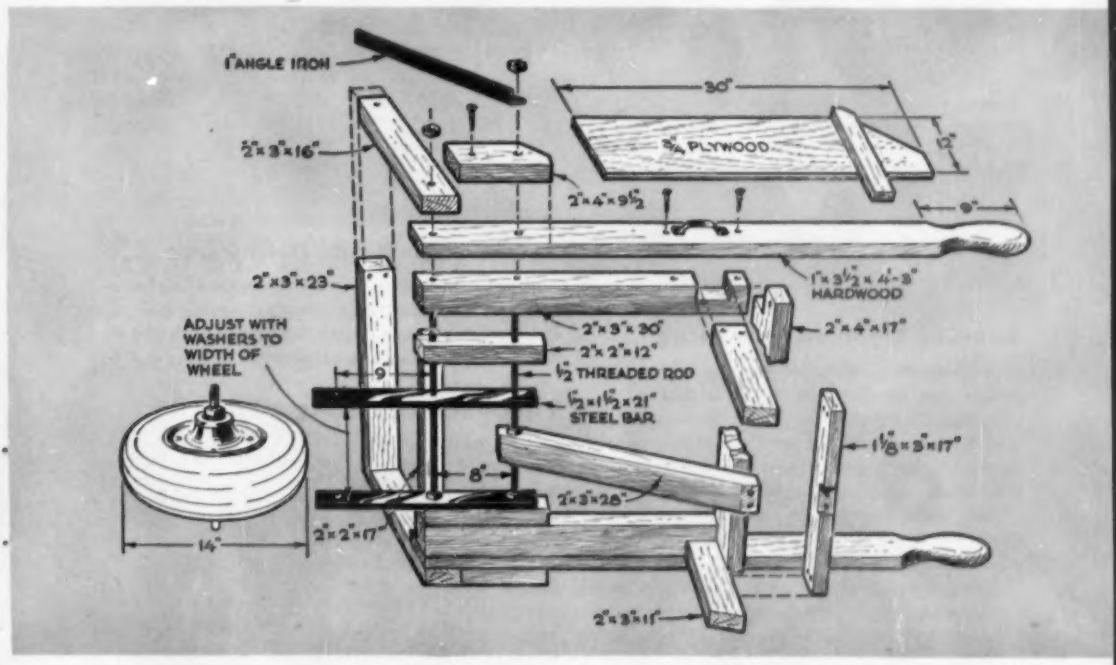
The Achilles' heel of many barrows is the axle supports, and these he made of ½″ steel-bar stock. Fastenings are another weak spot, particularly under racking stress, so this job was taken over by ½″ steel rods, threaded for periodic take-up. Lengths of steel angle protect the edges of the platform and back from frazzling. The framing members are all hardwood.

STEEL EDGING allows use of lightweight pine for floor and back. Careful count indicates that Old Indestructo has so far hefted 200 tons of dirt, 150 tons of stone, and 90 tons of concrete. It's ready for more.

THE KIDS GREW BIGGER but the barrow remained husky. It toted out more than 120 tons of dirt here, and brought in 40 tons of stone.

MELLOWED BY A DECADE, the barrow wouldn't hold the youngsters as readily now. Only repairs have been occasional reflooring, repainting.

Thrives on Toughest Jobs



Screwy Quiz

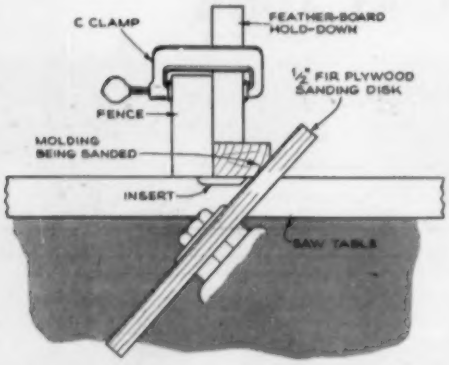
SCREW manufacturers apparently believe nine heads are better than one: they offer the assortment of screw heads below. Seven require special drivers, an eighth can be installed with an ordinary screwdriver but must be backed out with a special tool. If you can name all the types, don't admit it—your familiarity with No. 9 could be a source of embarrassment. (Courtesy Vaco Products Co.)

1. _____ 4. _____ 7. _____

2. _____ 5. _____ 8. _____

3. _____ 6. _____ 9. _____

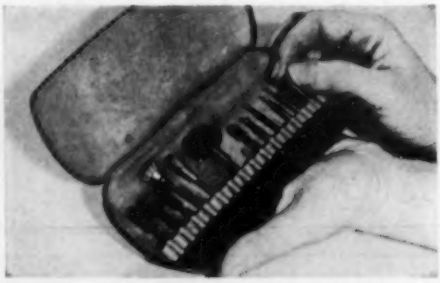
Answers to Screw Quiz: 1. Regular; 2. Phillips; 3. Frearson; 4. Allen; 5. Clutch Head; 6. Robertson; 7. Fluted; 8. Spanner; 9. Non-Removable or Prison Screw (used mostly in penal institutions).



Sanding Done on Saw Table

ACCURATE sanding of square or beveled pieces can be done by using a disk of ½" plywood to replace the blade in your table saw. Cement a disk of medium-coarse sandpaper to the plywood and mount it on the saw arbor. Make a maple table insert with a slot wide enough to take the plywood. Bevel one side of the slot to clear the disk when tilted.

Using the saw fence as a guide, you can sand pieces of molding, and all will come out the same width.—*Dick Hutchinson, San Gabriel, Calif.*



Specs Case Holds Drill Parts

A METAL case makes a convenient holder for the tools that come with a small drill. Fit a strip of corrugated cardboard into the lip of the case, as shown above.

Tip on Rustproofing a Lock

TO PREVENT rust forming in the mechanism of a padlock exposed to weather, place a piece of waterproof adhesive over the keyhole for a replaceable cover to defy moisture.—*Ken Murray, Colon, Mich.*

NEW Shop Ideas

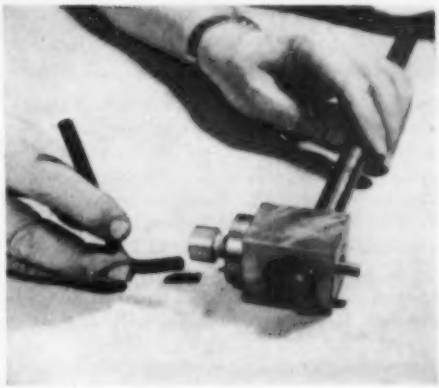
Quickie V Block. Three scraps of angle iron make a handy V block for the drill press or workbench. Even if you have a machined block, this one is worth making to save the other for precision work.

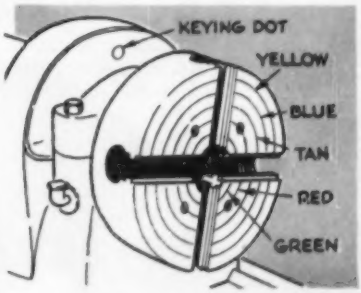
Cut two pieces of ½" and one of ¾" angle 2½" long. Clamp these as in the drawing, the small ones equidistant from the edges of the larger, and rivet all together. If extruded brass or aluminum angle is used for the upper member, square stock can be held as well as round since this material has a sharp inside corner instead of a fillet.—*J. M. Finn, Pittstown, N. J.*

Screw Extracts Pins. Even pins too stubborn to be driven out will usually yield to this persuader. To make it, mount a steel block in the four-jaw chuck with one face out. Bore a hole through for the workpiece, leaving at least 1" of stock between it and one side.

Rechuck with this side out. Drill straight through, slightly larger than the diameter of the pin to be removed. Then open out the 1" length to tap for a ½" Allen screw.

Chuck the screw and centerdrill it 3/16" deep to a drive fit for a piece of drill rod slightly smaller than the seized pin. Harden and draw the rod to straw color. Grease the screw to cut friction.—*Joseph Tracy, NYC.*



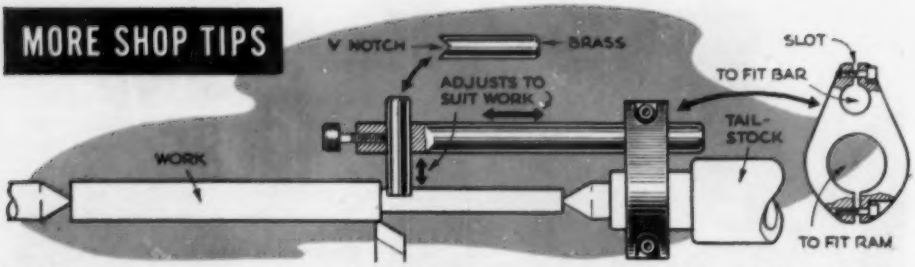


Shop Color Pays Off. Paint can be more than decorative in the workshop. Fill in the circles on a four-jaw chuck with different colors, and it becomes easier to set work true. Where there are two or more lathes, put a different spot of color on each headstock. Then paint backs of faceplates and chucks fitted to each lathe with the same key color.

Finish the rest of the machines, including motors and brackets, in a light tone. The light reflected from it will help in close work. Use white or aluminum paint inside cabinets to make tools easier to find.—*John A. Blaker, Auburn, Mass.*

Please turn the page for more shop tips

MORE SHOP TIPS

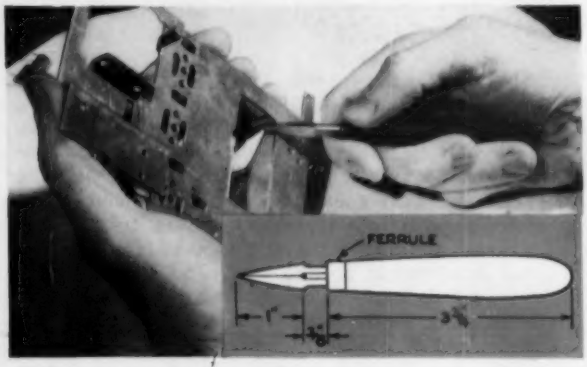


Back Rest Stays Put. Because it can be fixed to support slender work at its most flexible point, this simple back rest is sometimes more useful than a traveling or follower rest.

To make it, bore one end of a piece of ¾" or 1" stock to fit snugly over the tailstock ram. Bore the other end to hold the support bar. Then slot both holes as in the drawing. Tap for clamp screws on one side of each slot, and drill the other clearance size. Tap one end of the support bar for the setscrew that locks the shoe. Make this of brass, with a V notch at one end to seat against the work.—*H. J. Gerber, Stillwater, Okla.*

Cutting Dowels Flush. When dowel plugs are cut off flush with an ordinary saw, the surrounding surface is often so badly scratched as to require laborious extra sanding. An ordinary hacksaw blade, with the set of the teeth completely ground off on one side, will do the job cleanly. Don't mount the blade in a hacksaw frame, but simply wrap one end with tape to provide a hand grip.—*H. L. Luckett, San Antonio.*

Wrench as Drill Vise. Small pieces, dangerous to hold by hand on the drill press and hard to grip with a clamp or in a vise, can safely be drilled between the jaws of an adjustable wrench as shown above. Clamped on top of a wooden backing block, this can be set to allow duplicate parts to be slipped into place, drilled, and removed without changing adjustment. It's fast.—*Phil McCafferty, Stanwood, Iowa.*



Midget Scraper. Handy for deburring edges, cleaning work to be soldered, and opening out small holes, a scraper like this is easily made from an old triangular file. Break it off short, grind the stub to a point (be careful not to draw the temper) and hone sharp. The short business end gets into tight places, and with the fingers so close to it, there is accurate control.—*H. G. McEntee, Ridgewood, N.J.*

5 Household Hints

A GLASS BASTER like the one at the left makes it easy to water bushy plants. Flow can be controlled, does not spill.

A JAR RUBBER under a ceramic flowerpot will protect the finish of a painted window ledge. Cement it to the pot if you wish.

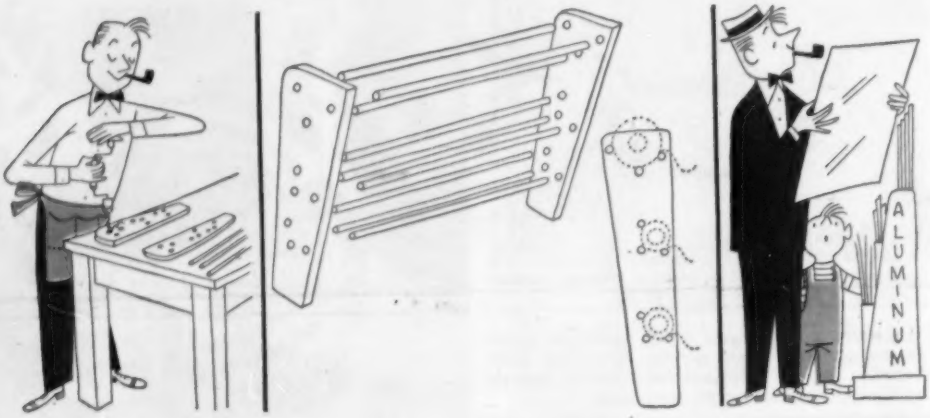
GRAPHITE DUST, available at hardware stores in tubes, will often silence squeaking floor boards. Sift the lubricant between the boards and carefully clean away any excess.

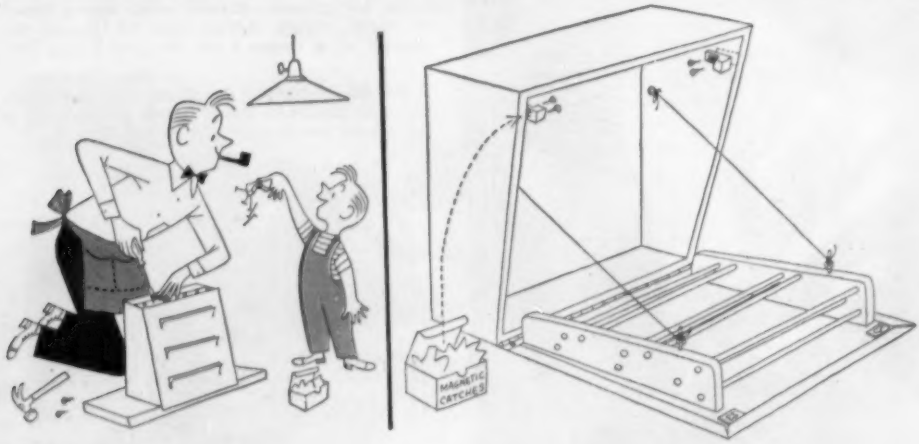
CAST-METAL FRAMES can be made to look like porcelain by giving them a coat or two of white refrigerator enamel with just a touch of burnt umber stirred into it. Or use the enamel as it comes from the can if you like.

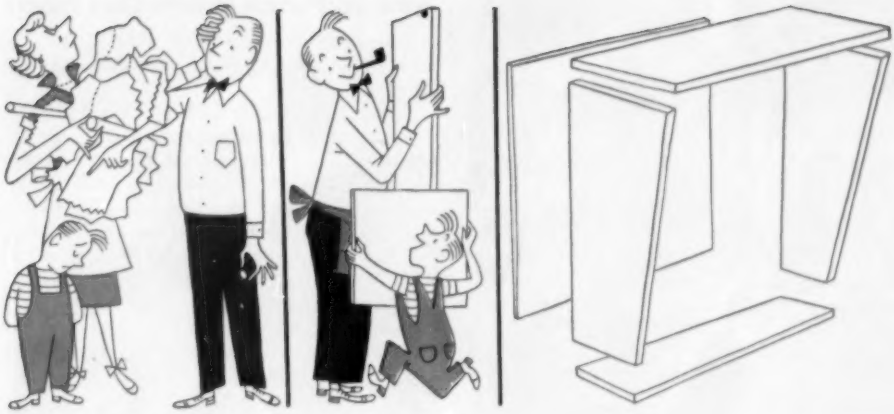
A SET OF MATCHING COASTERS can be quickly cut from linoleum scraps. Study the pattern to see where you can get the best design.

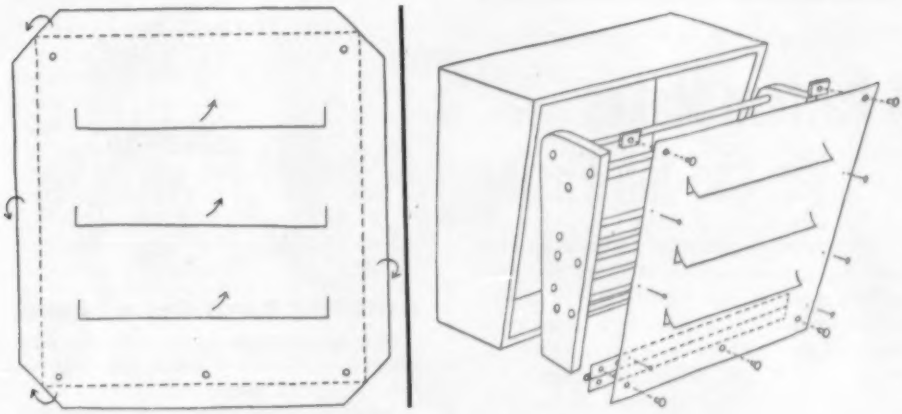
By Roy Doty

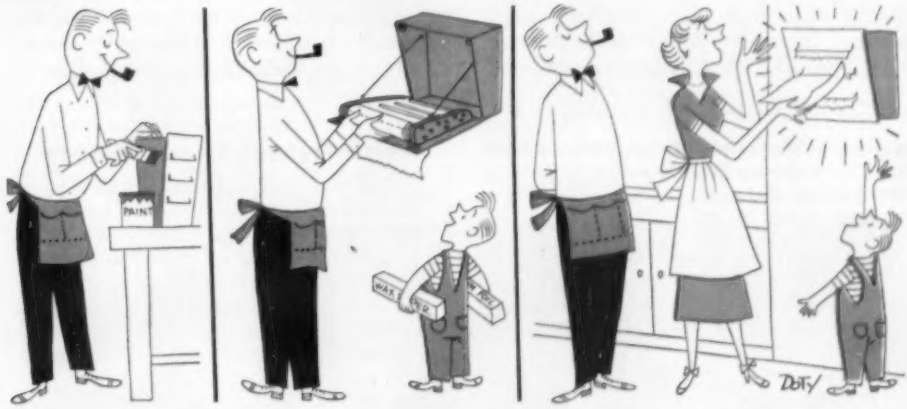
Wordless Workshop











Like a pattern for this dispenser? Please turn the page

How to Patch Worn-Out Lawn

ARE there bare spots in your lawn? Or areas where weeds have crowded out the grass?

Late August is a good time to remedy the situation with a new gardening aid, a product known as Lawn and Garden Cyanamid. This chemical kills crab-grass and other weed seeds as well as weeds already grown, then undergoes a chemical change and becomes a lime and nitrogen fertilizer.

To use it, mow existing grass and weeds closely, rake off the debris, loosen the soil with a rake, and water heavily. After applying the chemical, keep the area moist for a period of about three weeks. Then go ahead and sow grass seed.

A Pattern Makes the Job Easier

"WORDLESS WORKSHOP" projects can be built by experienced craftsmen without further instructions. But if you're a beginner, you might like full-scale patterns. So the editors have arranged with the McCall Corp. to supply them.

To secure a full-size, iron-on pattern for the wall dispenser on pages 172-3, send 60 cents (50 cents for the pattern, 10 for handling charges) to Wordless Workshop, Dept. 855—110W, Popular Science Monthly, 353 Fourth Avenue, New York 10, N.Y. Instructions included.

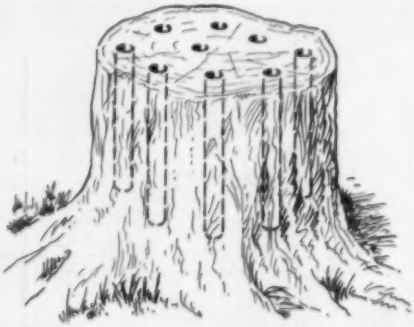
Wordless Workshop, Dept. 855—110W
Popular Science Monthly
353 Fourth Avenue
New York 10, N. Y.

Please send me a full-scale transfer pattern for the wall dispenser. I enclose sixty (60) cents.

NAME_____

STREET & NUMBER_____

CITY & ZONE_____ **STATE**_____



Saltpeter Burns Out a Stump

OLD tree stumps that are in the way are easy to burn out if you first impregnate them with saltpeter.

Bore a number of holes deep into the core of the stump and fill them with saltpeter crystals, available at drugstores. Pour hot water into the holes and repeat on successive days, until the crystals are completely dissolved. Set fire to the stump after it has had sufficient time to dry out thoroughly.

Bolts Tighten Loose Hinges

OLD door hinges that have pulled loose on outbuildings can be bolted so they'll really stay put.

Remove the side trim and run flathead stove bolts right through the hinges and the door frame and into nuts and washers on the back. This takes little more time than plugging the old holes, and the bolts will never pull out.—*Donald Fortune, Grandview, Wash.*

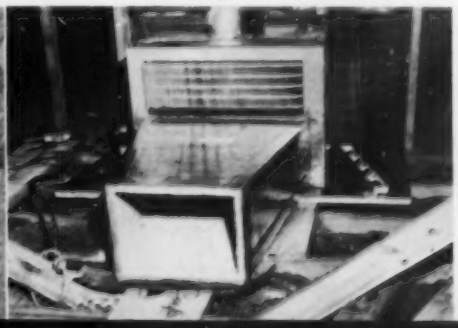
New for the Handy Man

1. Tile Laying on Record. You can install a tile floor while listening to this step-by-step phonograph record. The record comes with each carton of vinyl-asbestos tiles, enough to cover 36 sq. ft. An instruction booklet is also included—it's handy if you can't keep up with the record.

2. Seals and Glazes. You can resurface your basement washtubs with a new brushing or spraying liquid that seals leaks and provides a modern finish resembling porcelain or glazed tile. A thermal-setting plastic, heat-hardened by its own chemical reaction, it bakes into a porous surface such as concrete, stucco, plaster, plasterboard, hardboard, bricks and asbestos shingles. It is said to waterproof basements, chimneys and swimming pools, and to resist acids and alkalies. Comes in colors that won't discolor.

3. Prefab Ducts Cool Whole House. You can put these inexpensive ducts together and have a central air-conditioning system from one small cooling unit. The prefab ducts are sections of glass fiber that come collapsed. You just fold them into rectangles, cut them to length with a knife, and tape the seams (below left). The cooling unit (below right) has a 2-hp. motor and can be installed in an attic, crawl space, garage or utility room. It can be hooked to existing heating system.

[Please turn the page for more handy-man news]



4. Pattern Kit Includes Lumber. With these new pattern kits, you get precut hardwood that requires only final shaping to form a spice chest (shown above) or other project. Over 25 different pattern kits are available. Each includes 5/16″ finished hardwood and hardware.

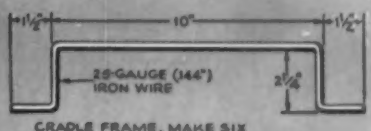
5. Garden Hose Becomes a Level. By screwing these plastic sight tubes to both ends of a hose, you can have a water level that lays out points of equal height even around obstructions. It works on the principle that water seeks its own level. It's handy for jobs where small levels can't be used.

6. Plastic Bricks Applied in Sheets. A new vinyl-plastic wall covering in 2′-by-4′ interlocking sheets, molded to look like brick and stone, is available for modern treatment of living rooms, dens and playrooms. You apply it with adhesive. It can be fitted with scissors, and will take paint.

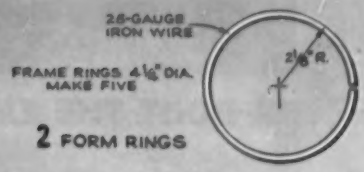
7. Knob Speeds Paint Scraping. The knob on this scraper lets you use it with both hands for slicing paint off faster. Turning the knob removes the blade or adjusts it to get into corners. The 5″ blade speeds work on house siding and other areas. Three smaller scrapers are also available.

Further information about the products described on this and the preceding page can be obtained from: 1. Armstrong Cork Co., Lancaster, Pa.; 2. Ev-R-Shield Products, Inc., Joppa, Md.; 3. O. A. Sutton Corp., 1514 W. Second St., Wichita, Kan.; 4. Veneer Lumber & Plywood Co., 2637 S. Throop St., Chicago; 5. J. B. Industries, P.O. Box 609, Great Neck, N.Y.; 6. National Vacuum Molding Corp., 923 Old Nepperhan Ave., Yonkers, N.Y.; 7. Hyde Mfg. Co., Southbridge, Mass.

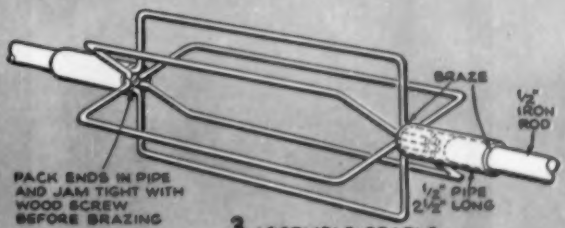
How to Build a Cradle Spit



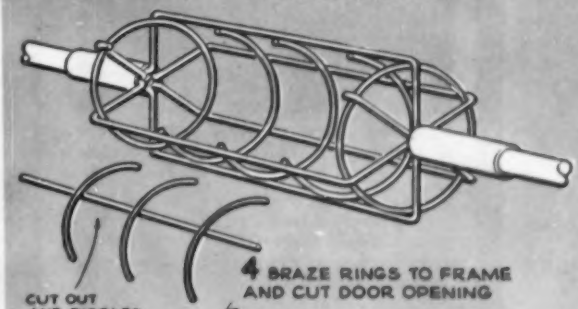
1 BEND FRAME PIECES



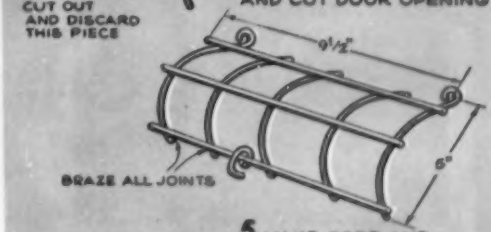
2 FORM RINGS



3 ASSEMBLE CRADLE



4 BRAZE RINGS TO FRAME AND CUT DOOR OPENING



5 MAKE DOOR AND HINGE TO FRAME

By J. M. Finn

THE cradle spit that cooks used in open hearths back in colonial days is also a useful accessory for back-yard fireplaces. You don't have to spear everything. Ear corn, potatoes and small meat cuts can be roasted on all sides.

Make the cradle or basket of 25-gauge (.144") iron wire. Bend six identical longitudinals (1) and form five rings (2). Pack the short ends of the longitudinals (3) into pieces of ½" pipe. Drive a wood screw into their meeting point to force them all evenly against the pipe wall. Braze the wire rings in place (4).

Cut out one longitudinal section and a segment of the three inner rings to make the opening for the door. Assemble and braze the door flat, leaving the ends long enough to form eyes. Then bend to shape (5). Close the eyes over one longitudinal to hinge. Make a latch from a short piece of wire.

Braze two pieces of ½" iron rod into the pipe ends to straddle the spit supports and add a handle for rotating the spit.

Rubber Skids Keep Kids from Swinging on Garden Gate

THIS may be a dirty trick to play on kids, but it sure protects a garden gate from being wrecked by swinging on it. I nailed a rubber sink stopper to the bottom of the gate about ⅛" above the ground. Under the weight of any small joy rider, the washer digs in and the gate drags to a halt.—*S. N. Stresnic, Bayside, N.Y.*

Block Guards Shade Roller

WHEN you shorten a window-shade roller and hammer the pin cap back into place, you can protect the delicate spring tip at the other end by inserting it in a hole in a block.

DO IT THE EASY WAY

PAINT IN SCREW SLOTS is easily cut out with one of your older coping-saw blades.

AN ANGLED SANDING BLOCK gets into crevices and other tight spots that you might have difficulty sanding otherwise.

A PAINT ROLLER made by wrapping a pipe cleaner around a nail projecting ½" from a dowel coats window putty neatly.

A LOOSE CASTER can be kept in its socket by wrapping the shaft with aluminum foil.

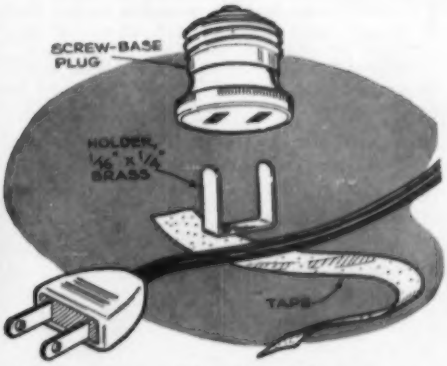
Signs with a Chuckle Liven Up Bare Garage Doors

My wife and I don't really get our cars mixed up, but these "His-Her" emblems provide an amusing as well as decorative touch to two otherwise blank garage doors.

I ripped ¾" strips of redwood for the letters and made them 7" tall by 4" wide (except for the "I"). The "S" and "R" curves were formed by cutting pieces at 45° angles. The letters were glued together and predrilled for screws so they could be fastened without splitting. Each word is framed in a 20" cocked square of 1"-by-3" redwood. *—Harold N. Moore, Kenwood, Calif.*

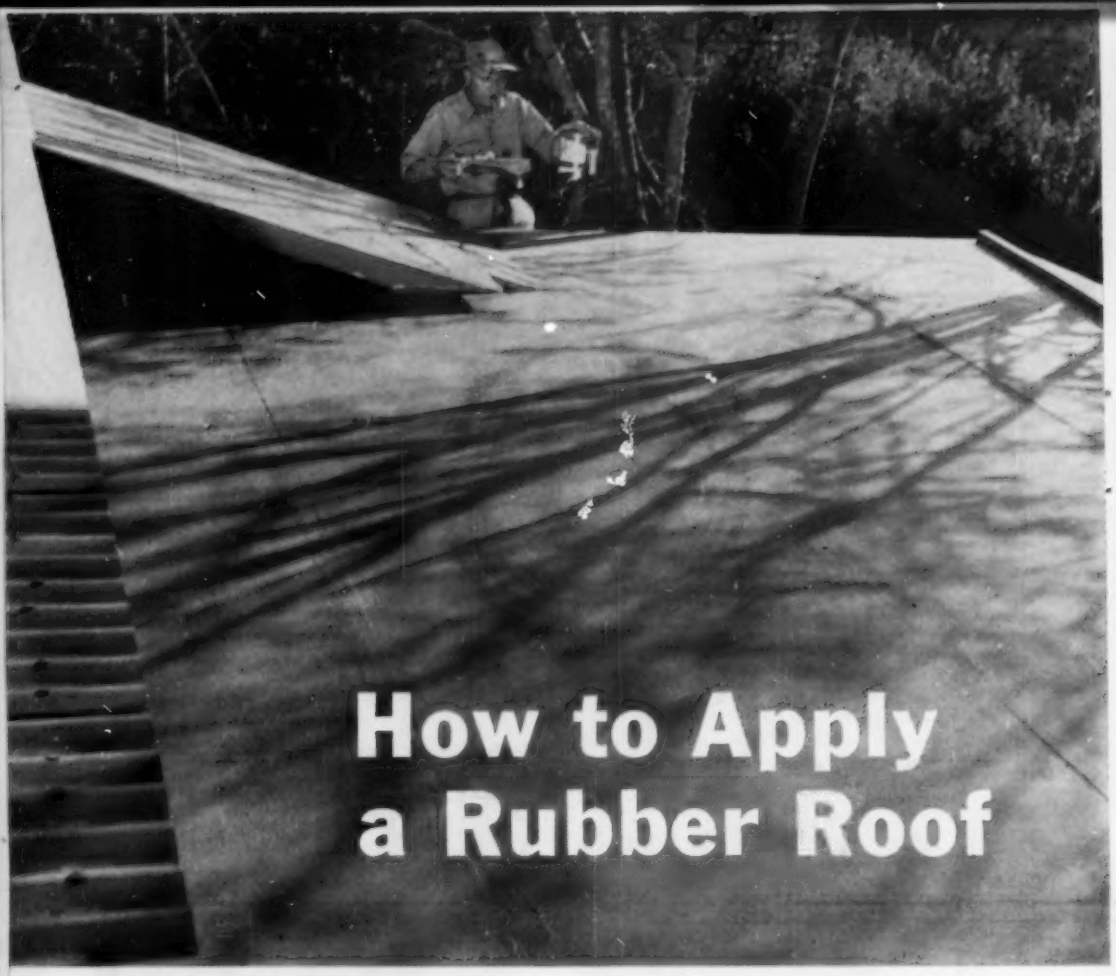
How to Silence a Doorstop

A doorstop that gives off a thud every time the door hits it can be quieted by slipping on an auto-distributor nipple. The soft rubber will also protect door paint. *—Ken Murray, Colon, Mich.*



Emergency Electric Plug

When you need a trouble light or drill near a screw-type receptacle, it pays to have a screw-base plug at hand. Bend up 1/16"-by-¼" brass prongs and tape them to the cord. *—David Jenkins, Xenia, Ohio.*



How to Apply a Rubber Roof

IF YOU can handle a paint roller and brush, you can breeze through the usually tough job of waterproofing a flat or gently sloped roof. There's no need to tangle with messy tar and gravel—everything but the carpentry comes in a can.

The material that does the trick is liquid neoprene, the synthetic rubber that sticks to everything from cloth to concrete, goes on like paint, and dries to form a durable elastic coating that will last for years.

Now available with aluminum coloring added—we used Gaco N-700—liquid neoprene may not seem like a bargain, costwise. You have to figure on two coats, at three cents a square foot for each application. Add the cost of two base coats of neoprene primer, plus the neoprene putty needed to seal all wood joints, and a rubberizing treatment is probably half again as expensive as a tar-and-gravel finish. But the ease of applying liquid neoprene more than offsets the few extra dollars spent on materials, particularly in the case of a small cabin or carport roof.

If you start your roofing operation from scratch, use exterior plywood, rather than roofers. The big sheets go up fast and leave a minimum of joints to fill. The thickness of the plywood depends on the spacing of your rafters. FHA specifications call for ⅜″ plywood for rafters on 16″ centers, ½″ for 24″ centers, and ¾″ for 48″ centers. Place the sheets so the face grain runs at right angles to the rafters and nail blocking between the rafters to support all butting edges.—*Darrell Huff and Paul Corey.*

1 COAT ALL EDGES of plywood roof panels with neoprene primer before nailing them to rafters. Stacking panels speeds the work. Where the roofing is already in place, soak all of the seams thoroughly with primer.

2 APPLY NEOPRENE PUTTY, mixed with the accelerator paste which comes with it, to mating edges of plywood just before you butt the free panel to ones that are already nailed down. Level excess putty with a trowel.

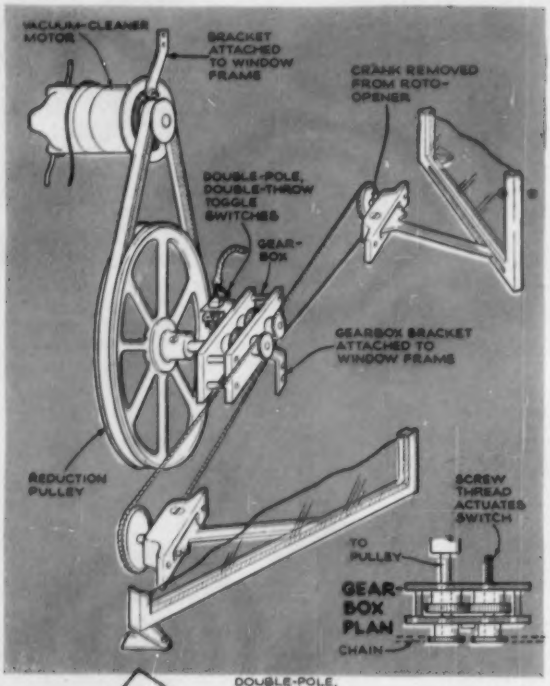
3 ON NEW ROOFS, apply two coats of neoprene primer. Old roofs need a washing with neoprene solvent, first. The roof shown here was rubberized after another type of joint-calking had proved unsatisfactory.

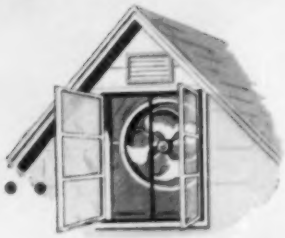
4 ROOF IS NOW READY for its first coat of liquid neoprene. You can do the whole job with a brush, but a roller is faster. Either way, use a brush to work up close to edges like this one. Use solvent to clean the brush.

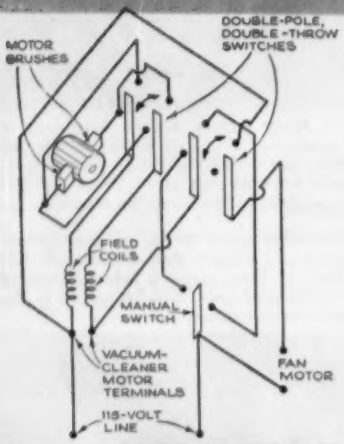
5 LAMB'S WOOL ROLLER lays on neoprene with little effort. Apply the liquid liberally, rolling it just enough to level off the surface. Move right along, as the solvent in the neoprene evaporates very quickly.

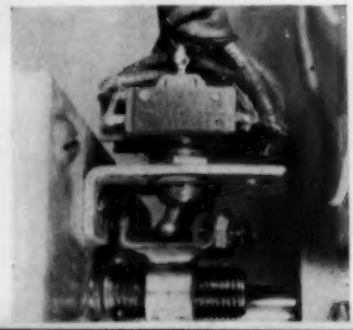
6 AFTER THE FIRST COAT DRIES, press neoprene putty into any cracks that the liquid has failed to bridge. Now apply a second coat of neoprene. Additional coats can be added if the surface still remains uneven.

Vacuum-Cleaner Motor Opens Window for Attic Fan









OUR attic fan exhausts through a casement window, which has to be closed when it rains and kept open when the fan is running. That meant innumerable trips up and downstairs until I rigged up a simple, remote-control unit, powered by an old vacuum-cleaner motor.

Now, when I flip a switch on the lower floor, the window opens and the fan goes on. Reversing the switch closes the window and shuts off the fan. It's a perfect setup: cools the house when we need it, and saves a lot of stair climbing in changeable weather.

The vacuum-cleaner motor is the heart of the controlling mechanism. Wired to two double-pole, double-throw toggle switches, it runs only when the manual switch downstairs is thrown, and stops when it has moved the window to the desired position. At either extreme of window travel, a threaded shaft turned by the motor raises or lowers a nut brazed to a yoke which trips both toggle switches. One opens the motor circuit and reverses connections so the next movement of the manual switch will run it the opposite way. The other turns the fan on or off.

While running, the vacuum-cleaner motor swings the two sashes in or out. A belt drive to a large pulley wheel cuts speed, and identical, meshing spur gears provide counter action.

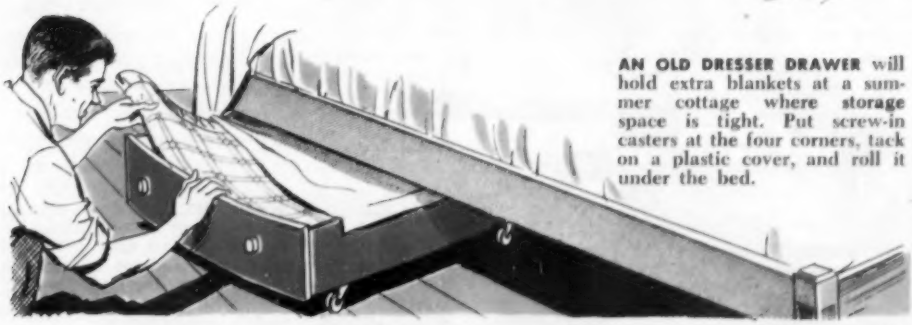
The crank handles used to move the sashes manually were removed, and the shaft ends were filed down to take a pair of sprocket wheels. Chain drives from another pair of sprocket wheels mounted on the spur-gear shafts transmit power from the gearbox.—*W. E. Lang, St. Louis.*

KEEPING THE *Home* SHIPSHAPE

A HANDY KITCHEN FILE for bills and memos is a spanking new dustpan. Buy one that has a dust catcher at the handle end, hang it blade up and snap a band of garter elastic across the upper part to keep papers from sliding out.

A HOLE IN THE GROUND, lined at the sides with bricks or field stones and at the bottom with a layer of small stones, makes a back-yard barbecue that will double as a trash-burning pit all the year round.

STORE THE FOOD CHOPPER and all its parts in a round oatmeal box, and you'll never have to search through drawers to find a rarely used cutting disk. The box will keep the chopper dustfree, too.



AN OLD DRESSER DRAWER will hold extra blankets at a summer cottage where storage space is tight. Put screw-in casters at the four corners, tack on a plastic cover, and roll it under the bed.

Please turn the page for more home tips

More Home Tips

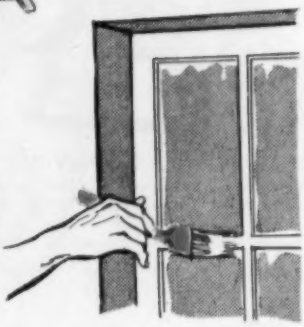
TO SHIELD YOUR HAND FROM HEAT when you're roasting wieners over an open fire, impale a foil pie pan on the stick as a guard. Or use a 6" square of heavy foil wrapping. If the foil guard slips, twist wire around the stick and over the edges of the punched-out center.

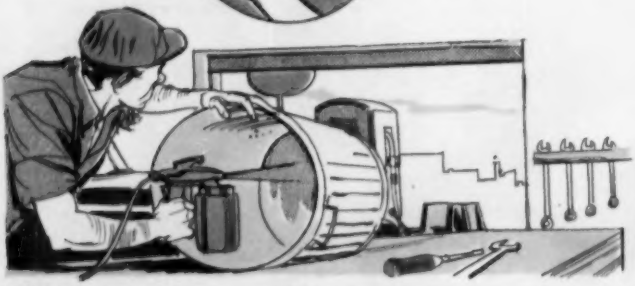
TO PROTECT young trees and shrubbery, cushion the crossbar of your lawnmower with a split length of garden hose. Bind the ends to secure the hose in place.

STOP THE WOBBLE. Lengthen a short leg on a wooden chair by setting it on a blob of composition wood squeezed onto wax paper on a level surface. When dry, trim with a knife and sand it smooth.

IF IT MARKS WASH, coat an aluminum clothesline with spar varnish. Remove dirt and grease with solvent first; then wipe the line with a varnish-saturated cloth. Warn the family to be sure it is thoroughly dry before hanging any wash.

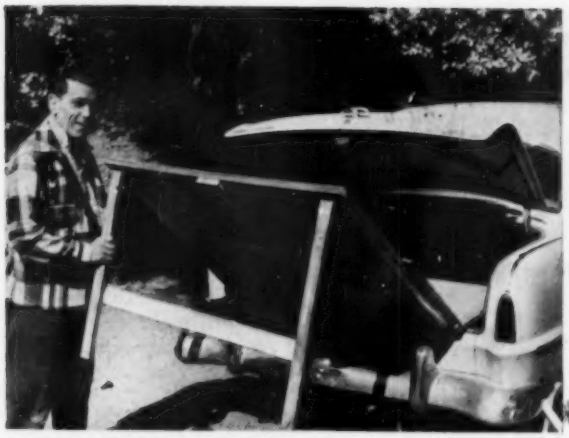
WHEN YOU PAINT newly puttied windows, don't worry if a little paint runs onto the pane as long as the putty is thoroughly dry. It will call leaks from poor priming or inferior putty. You can scrape excess paint from the glass quickly with a razor blade.



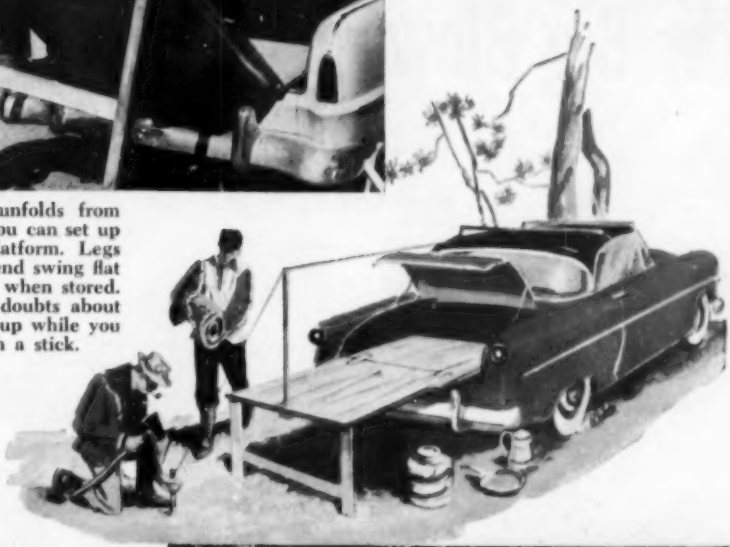


WARD OFF RUST the next time you buy a new garbage can. Shell out just a few cents more and get a garage man to spray the inside bottom with protective automobile undercoating.

Pull-Out Bed Converts Car to Camp



EIGHT-FOOT BED unfolds from trunk as fast as you can set up a three-section platform. Legs supporting outer end swing flat against underside when stored. If you have any doubts about trunk lid holding up while you sleep, prop it with a stick.



YOU can pitch your tent in the trunk of your car with this portable bed platform and have comfortable sleeping for two on overnight camping trips. By day the bed folds flat into the trunk, taking practically no space.

Cut a 4′-by-8′ sheet of plywood in half (⅜″ or ½″ thick will do) and strengthen the edges by nailing on 1″-by-2″ strips. Then hinge the two sections together so that the flat sides fold together.

The inner section rests on the spare wheel, laid across the floor to raise the platform above the trunk sill. Fasten the legs to the outer section with locking-type bracket hinges, or if you use regular ones slant the legs outward a bit to keep them from collapsing inward.

With an air mattress or sleeping bag, the auto-Pullman is complete. And you can put it to other uses, too—as a picnic table, as a beach back rest when slanted against its legs, or as a shelter against wind for cold-weather fishing and hunting expeditions.—*Al Grandmain.*

ARMY PUP TENT just fits over trunk lid, or you can use canvas or a blanket. Pole supporting tent rope fits in hole in platform, blocked underneath. Guy rear rope to stake, front one to roof carrier or down hood to bumper.

Strong winds blow houses up, not down, engineers say. Here are tricks they learned about

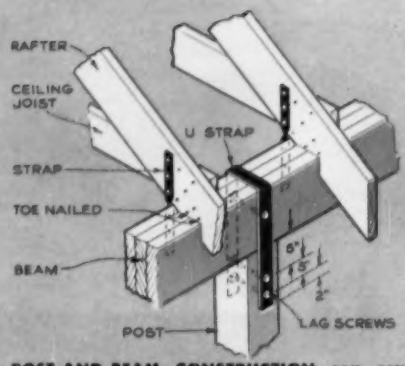
Building for the Big Blows

WHEN last October's Hurricane Hazel finally blew herself out to sea, she left more than 3,000 wrecked or damaged buildings in the state of Maryland alone. Engineers from the University of Maryland decided to find out why.

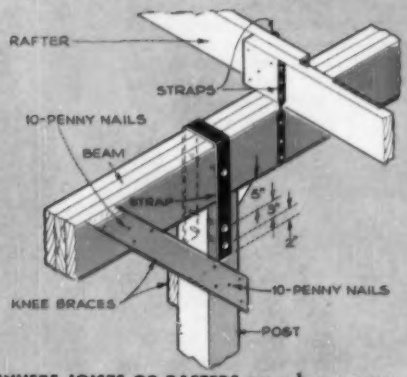
Most of the damaged buildings were small and light—construction such as you might use for a garage, shed or summer cabin. Also hard hit were those with flat or shed roofs—the sort you might put on a porch, carport or sun deck.

Because wind blowing across the top

You can use new post-and-beam method for strong structures



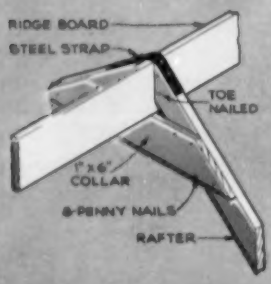
POST-AND-BEAM CONSTRUCTION can save work and lumber. Use a few big pieces instead of many little ones, but they need firm anchoring. Heavy U strap keeps beam from lifting and shifting sideways. As in other construction, joists and rafters should be anchored with metal straps or ties.



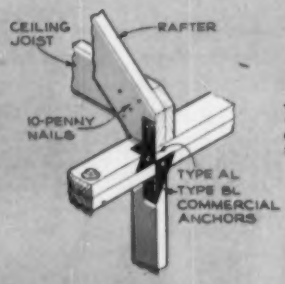
WHERE JOISTS OR RAFTERS cross beam, overlapping ends should be side-nailed together and tied down with metal straps, not simply toe-nailed. Knee braces, staggered one on each side in opposite directions, keep the posts from twisting and tilting under end strain on the beam.

Here are three ways to keep the roof really pinned down

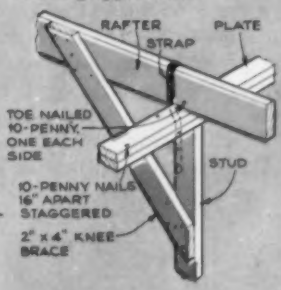
ROOF RAFTERS are locked together by a steel strap nailed over the ridgepole and into the edges. Short collar beams under the ridge as well as regular beams at ceiling height add strength.



METAL TIE PLATES have web at right angles that helps prevent shifting and twisting of framing members. The plates come in a variety of types, and can be used to strengthen almost any joint.



FLAT OR SHED ROOF can also be anchored with metal straps or ties. Diagonal knee braces also add tremendous extra strength at points where you can put them in without harming appearance.

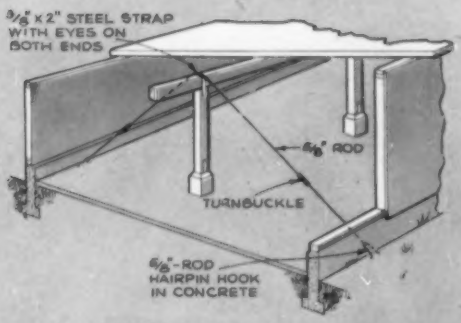


of a roof creates a vacuum—the kind that holds up an airplane—it can exert an upward force as great as the direct force against the side of a building. On a flat roof, with no peak to break the air flow, it can be even greater.

A carport or porch not properly tied down is like a wing poised for take-off—and may do just that. In Maryland, more buildings blew up than blew down.

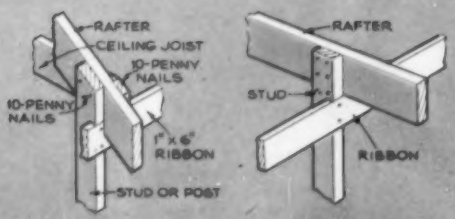
Here are methods devised by University of Maryland engineers to help make sure that what you put up will stay down.

Here's an idea you may like to try at a seaside cottage



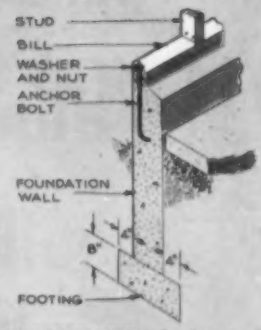
DETACHABLE TIE RODS can be put up in a few minutes for temporary bracing, or left in place when you close a summer cabin for the winter. Permanent anchors should be embedded in the foundation and bolted to the beams. You then simply hook in the rods and tighten them with turnbuckles when needed.

Small buildings are sturdy when put up this quick way

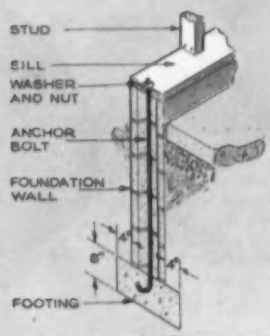


FOR A CABIN, garage or other light structure, here's a way you can save time and lumber, yet gain strength. Roof rafters are side-nailed directly to studs, instead of resting on a plate, giving them as much resistance to upward strain as downward. Both stud and joist are nailed to gable rafter.

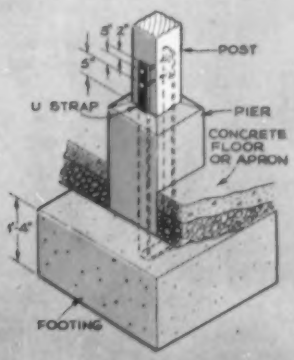
These are three good, solid ways to anchor a building



POURED FOUNDATION is strongest, needs ½" L-shaped sill bolts extending down 16" to keep frame from pulling off. Space 5½' for gable roof, 4' for flat or shed.



BLOCK WALL IS WEAKER, but you can make it stand up by running sill bolts through core holes into footing. In many storms, short bolts may rip off top row of blocks.



PIER SUPPORTS can be strengthened by running a U strap from post into footing. To prevent tipping, footings should be 2½' square for gable, 4' for flat or shed.

6 USES FOR Tin Cans at a Summer Camp

TO GET RID OF ANTS, punch a hole in the bottom of a large can, invert it over the anthill and pour in a little carbon tetrachloride.

A FLASHLIGHT HOLDER, made by cutting the top and bottom from a small juice can, will keep the lamp where you can find it. This size will admit the body of the usual light, but not the head. Mount the flashlight holder on the wall.

FOR A BUOY to mark a good fishing or anchoring spot, solder a ring to the lid of a coffee can and solder the lid on the can. Paint the can a bright color, yellow perhaps.

FOR SAFE DISPOSAL of razor blades, punch a slit in the top of a can with a chisel. A small can will hold plenty of used blades.

A WATER TRAP at each table leg will discourage crawling insects from getting on the table and into the food. Fill the outer can with water. The inner one keeps table leg dry.

SAFETY ASH TRAYS are right at hand if you use cans that have been opened with a beer-can-type opener. Drop in the butts—and you'll never be accused of setting a forest fire.

I Fly a Control-Line Trainer

It looks like a refugee from a Venetian-blind factory, but it flies fine—and it won't stall.

By James Webb

The prop is spun . . . the engine roars . . . must remember . . . pull back on stick, then ease off . . . in the air now . . . everything's going by so fast . . . trees . . . sky . . . water . . . trees . . . a blur . . . beginning to feel dizzy . . . nose down again . . . must pull stick back . . . there's the sun . . . dazzling . . . can't see very well . . . she's stalling . . . Crash!

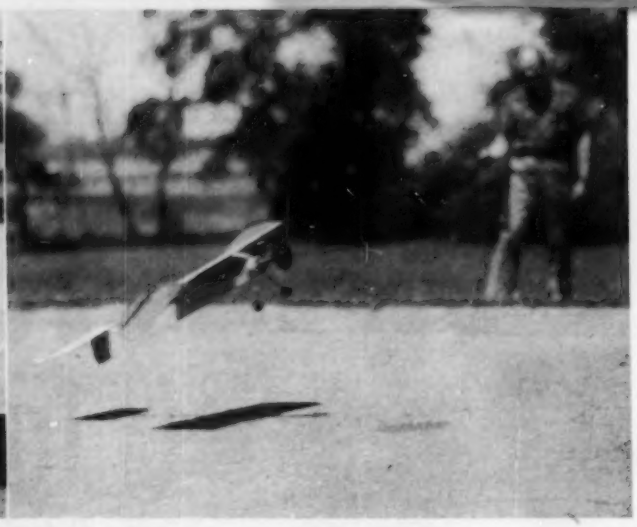
I'd cracked up on my first solo flight.

OF COURSE I could walk away from it—you always can; that's a big advantage in flying control-line models over the real thing. But the crash discouraged me from getting a model for the kids. Now, here was Roy Clough Jr., whose model I'd cracked up, with another plane, a funny-looking one. The wing was a series of slats with air spaces between. And there was a big cardboard disk in front of the prop.

"What have you got there?" I asked.

Roy had been mighty nice about his plane—explained that lots of beginners cracked up control-line jobs because they are so fast and so easy to stall if you freeze on the controls. Then he grinned.

"This," he explained, "is a control-line model designed especially for beginners—a basic trainer. She's slow and she won't stall. Swell for kids to learn with. Why,



After a flight checkout ..... away she goes .....

I bet even *you* will be able to fly her."

I was in no position to resent that. Instead, I asked for a demonstration.

The little plane took off slow and easy and went around the circle with a lazy lope like a tired hound-dog. Then Roy stuck her nose up and held it there. Instead of stalling and crashing, she kept mushing around, nose in the air, even slower—walking speed.

Roy wasn't kidding. This little job was as different from the model I'd flown before as a cub trainer is from a Shooting Star. "What's the secret?" I asked.

He pointed to the slat wing and the prop disk. "The disk spoils the air stream from the prop so that the plane travels slowly. And she gets the lift to keep going at low speeds from this fancy wing. Air compressed under the wing by the forward motion is squirted through the spaces and over the slats to provide the lift.

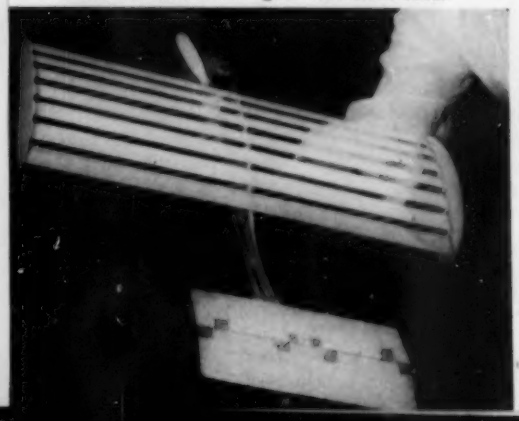
"And notice the low angle of that front strip," he went on. "That's what keeps her from stalling even when the nose is way up."

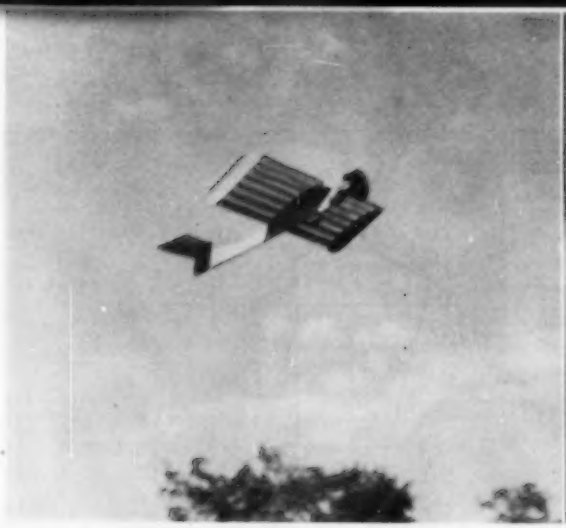
I took the controls, and Roy was right. Even I could fly this job, and I could turn her over to small fry with little risk of a discouraging crack-up on the first try. What was equally important, I found I could build a trainer model for the kids myself. So can you. Here's how to go about it.

Fuselage. Trace the fuselage outline on a sheet of ¼″ balsa and cut it out with a razor or a modeler's knife. Cement a 1⅜″-diameter disk of ½″ plywood to the nose for the engine mount. Then add two half-round blocks of balsa, faired from the disk to the fuselage, to reinforce the engine mount and hold the mounting nuts and landing gear in place. Cement the cloth-hinged tail surfaces in place and brace them with two wooden toothpicks. Bend a tail skid from soft wire, press it into the fuselage, and secure it with cement.

Wing. Cut the slats for the Venetian-blind wing from ⅛″ balsa and cement them to tip racks made from scraps of ¼″ balsa left over from the fuselage. These tip racks must be stepped or

WING SLATS set at varying angles, ranging from negative (downward) angle at leading edge of wing to positive (upward) angle at trailing edge, give lift at low speeds. The tail surfaces are hinged with cloth tabs.





..... **climbing high** ..... **into the sky** .....

notched exactly like the fuselage for good alignment. Add 1/16″ tip plates to the wing and cement to the fuselage. Coat the model with fuelproof dope to protect it from the engine fuel.

Controls. Cut a T-shaped bell crank from tin-can stock and pivot it on a nail pressed into the fuselage. Link the control crank to the elevator horn with a length of 1/32″ music wire. Support the wire at its center by a piece of plastic soda straw cemented to the side of the fuselage. Tie and cement a 25′ length of light fishing line to each leg of the bell crank and pass the lines through the wire loop on the wing tip. Trim the free ends to exactly the same length and attach them to the control handle.

Engine. Almost any small half-A engine can be fitted to the mounting disk. Just be sure the engine shaft is mounted at a slight downward angle for good low-speed behavior. Fit it with a 6″ propeller and kill its efficiency by fastening a 3″ disk of cardboard in front of it.

Operation. As soon as the trainer was finished, the kids and I took her out to the empty lot next door. With Roy along to give us some expert advice, we quickly got the hang of it and could walk her around the circle without any trouble.

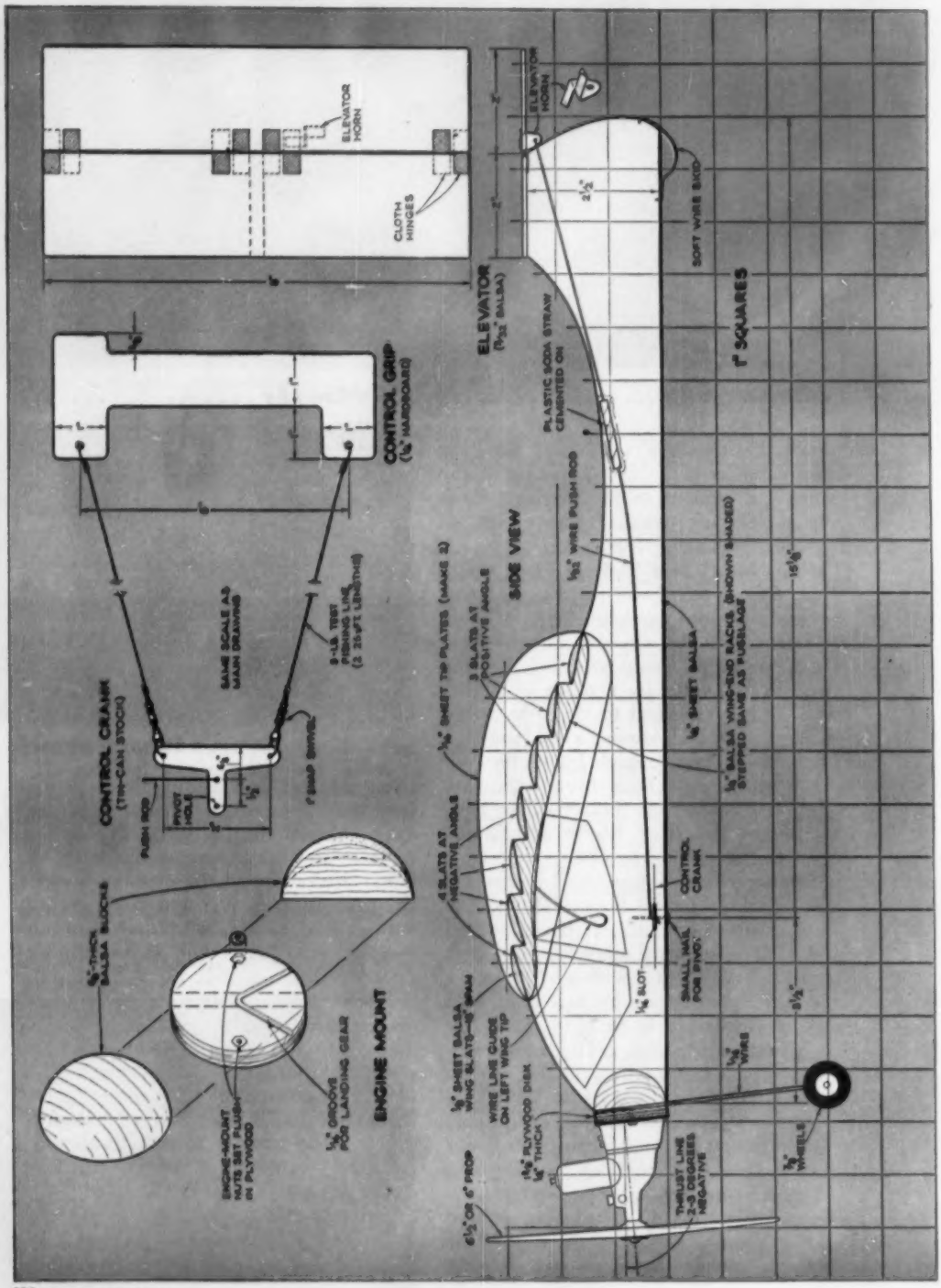
Engine tune-up. After you've been flying a while, you may find your engine getting cranky and hard to start. This probably means that a gummy deposit

..... **What a show!**

from the fuel is clogging the tank and feed line. They can be cleaned with lacquer thinner. But a word of caution. Even a tiny half-A engine has nasty exhaust fumes; spend the evening in your shop turning her over and you'll end up with a bad headache. Have plenty of ventilation, or better still, do your tuning-up outdoors.

Fueling. Your fuel comes ready-mixed—a typical formula has castor oil plus methanol plus nitro-paraffins—in half-pint cans that cost about 55 cents. This may seem pretty high on a gallon basis—$8.80—but you'll find it's only slightly over a penny a flight. You can fill the tiny tank with an eye dropper, but it's a lot easier and safer to use a miniature pump that any model-supply store carries.

Starting. Prime the engine first until it slops over—don't try to be neat if you


ELEVATOR HORN
CLOTH HINGES
ELEVATOR (1/32" BALSA)
CONTROL GRIP (1/8" HARDBOARD)
SAME SCALE AS MAIN DRAWING
CONTROL CRANK (TIN-CAN STOCK)
PUSH ROD
PIVOT HOLE
1" SNAP SWIVEL
9-LB. TEST FISHING LINE (2 25-FT LENGTHS)
1/8" THICK BALSA BLOCKS
ENGINE-MOUNT NUTS SET FLUSH IN PLYWOOD
1/8" GROOVE FOR LANDING GEAR
ENGINE MOUNT
1/8" SHEET TIP PLATES (MAKE 2)
3 SLATS AT POSITIVE ANGLE
SIDE VIEW
4 SLATS AT NEGATIVE ANGLE
1/8" SHEET BALSA WING SLATS—18" SPAN
WIRE LINE GUIDE ON LEFT WING TIP
1/8" PLYWOOD DISK 1/4" THICK
6 1/2" OR 6" PROP
1/32" WIRE PUSH ROD
PLASTIC SODA STRAW CEMENTED ON
1/8" SLOT
THRUST LINE 2-3 DEGREES NEGATIVE
1/8" SHEET BALSA
1/8" BALSA WING-END RACKS (SHOWN SHADED) STEPPED SAME AS FUSELAGE
CONTROL CRANK
SMALL NAIL FOR PIVOT
1/32" WIRE
1/8" WHEELS
SOFT WIRE SKID
1" SQUARES

want easy starting. Then hook on the batteries—a couple of 1½-volt jobs wired in parallel. These supply the juice to heat the glow plug that ignites the fuel inside the cylinder. One contact goes to the glow plug, the other to the engine frame. You can make your own connecting wires, but again it's easier to use a ready-made wire with a neat double tip that fits exactly and costs only 35 cents. Of course, you disconnect the batteries as soon as the engine catches.

Before spinning the prop, set the fuel-air-mix screw at the point recommended by the manufacturer—usually three to five turns open. If the engine catches readily but then dies, your mixture is too lean. If it does this even with a rich mixture, your fuel line is probably clogged.

Once the engine catches, the engine will sputter and spit, so lean the mixture until it roars smoothly (it will really roar, too).

Controls. Be careful when you unwind the reel not to cross the control lines. Operation is simple. Hold the reel vertically, with the end upward that is connected to the up action of the elevator. (Mark this end with a red dot on the reel.) Then you pull the top of the reel back to make the plane rise; the bottom to make it dip.

Flying. It takes two people to handle any control-line plane: one to spin the prop, one at the controls. If there is no bare earth or pavement handy for the take-off run, the prop handler will have to hold the plane in the air and give her a little toss forward; she won't take off from grass. The take-off run should last 10 or 15 feet. Level off after a slow climb. Gentle the controls; the plane responds readily as she picks up speed.

If you freeze onto the controls with the nose up, the trainer will just mush around instead of stalling. But don't get in the habit if you plan to fly conventional models.

You may think the fuel supply is very small; later you can add auxiliary tanks for longer flights. Actually, however, you'll find at first you can get pretty dizzy even with a short flight.

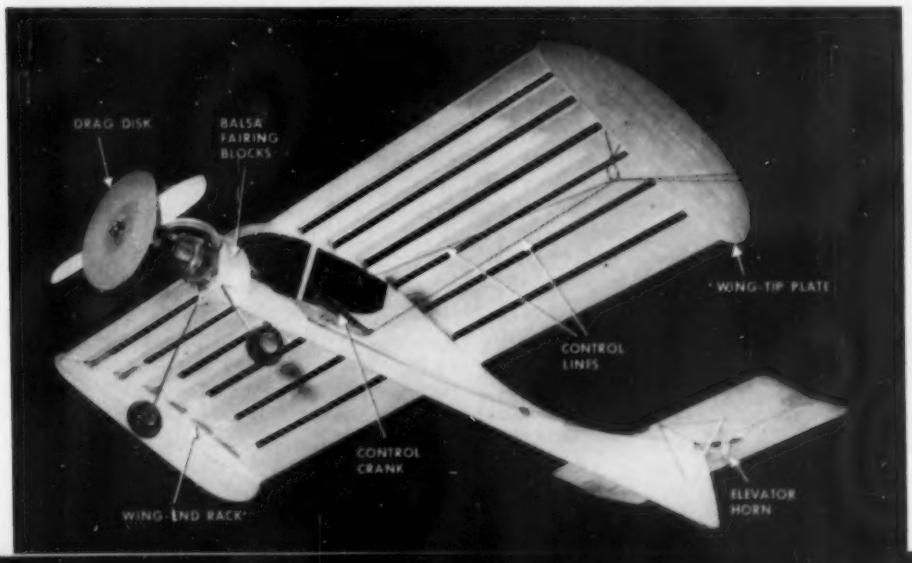
Props. You can vary the speed considerably with different combinations of props and spoiler disks. Those recommended for the plane fly her about as slowly as she'll go and still take off.

You'll soon find props are expendable, so take along half a dozen spares.

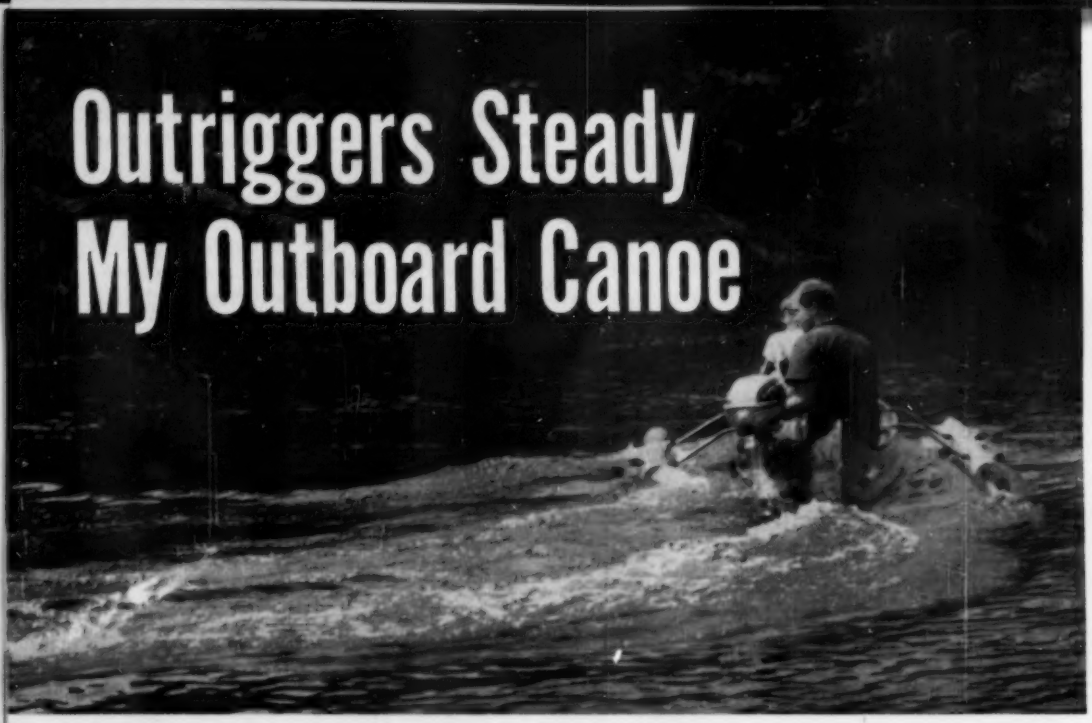
Beware the wind. Because the trainer flies so slowly, she develops very little centrifugal force to keep her out at the end of the control lines. Even a slight breeze may blow her toward you as she flies cross-wind—and if the lines slacken, your control is lost. If necessary, keep lines taut by running downwind. END

A TIN CRANK transmits your pull on control lines to elevator. Lines are attached to a control stick hand-held in vertical position.

The plane climbs when you tilt the stick back, dives when you ease it forward. Cabin windows are painted on the fuselage.



Outriggers Steady My Outboard Canoe



By Dr. W. Dan Haden Jr.

THESE lightweight outriggers turn a canoe into a sturdy, all-purpose craft that will do almost anything. The pontoons make it easy to put on an outboard without unbalancing the canoe, even though the motor has to be mounted on a bracket to one side of the rear seat.

Best of all, there's no dashing for shore when a wind blows up. It stays as sturdy as a rock. And you can take the whole family along with you.

The rig we made has two arms that just clamp across the thwarts. It's easy to carry and store, and can be put on or taken off in minutes without leaving any mounting holes to spoil the canoe.

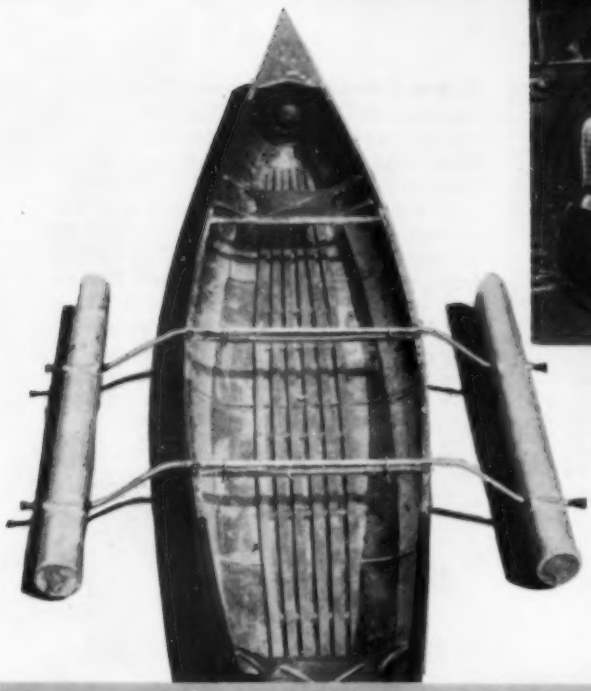
We scouted a bit for something to make good pontoons, then settled on lengths of 6″ aluminum irrigation pipe, and closed off the ends. These are light, rustproof and easy to make watertight if you have facilities for welding or hard-soldering sheet-aluminum endpieces to them. Another way would be to turn wood plugs to fit, and screw and cement them in, or to spin aluminum tips.

The crossarms are ½″ galvanized electrical conduit, which is a lot lighter than pipe, yet has plenty of strength and won't corrode. Most of the electrical-supply houses that sell the conduit also have bending machines and can form the arms to the desired shape for you.

Instead of fastening the arms directly to the pontoons, we simply slipped the ends through 1″ aluminum-tube sleeves welded into the top of the pipe. This way, we can dismantle the entire rig in a few minutes, and the loose joints give under strain that might damage a rigid fitting.

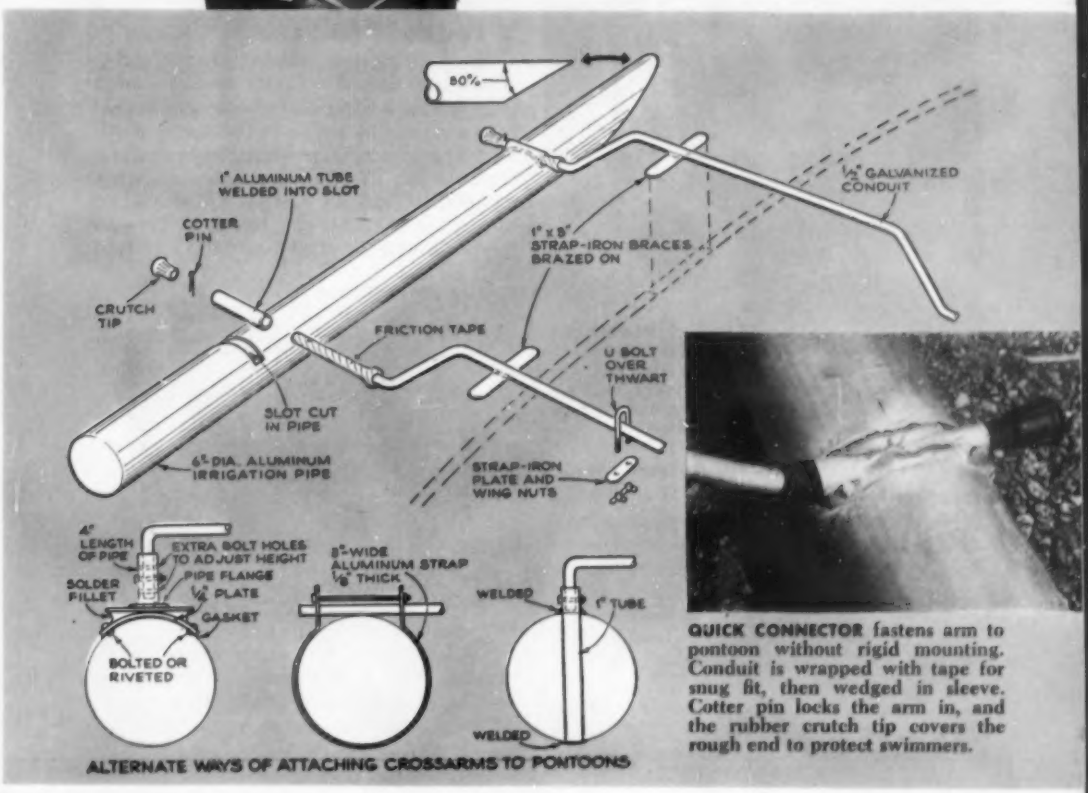
The crossarms are clamped to the thwarts by U bolts fitted on the underside with strap-iron plates and wing nuts for quick removal. These are turned up snug, but not with pliers since too much force might dent the tubing and weaken it. To keep the arms from twisting under the clamps, we brazed on small 3″ lengths of strap iron where they cross the gunwales of the canoe.

The floats should just touch the water at the rear with the canoe empty and slope slightly upward toward the bow.



FAMILY OUTING is possible because pontoons stabilize canoe even under the weight of eight persons. Canoe also remains level despite off-center load of outboard motor on one side.

OUTRIGGER ARMS (left) are spaced to match thwarts so they can be clamped to them. On small canoes without center thwart, arms can be led back from the forward thwart. The 5′ pontoons extend 18″ out from each side.



ALTERNATE WAYS OF ATTACHING CROSSARMS TO PONTOONS

QUICK CONNECTOR fastens arm to pontoon without rigid mounting. Conduit is wrapped with tape for snug fit, then wedged in sleeve. Cotter pin locks the arm in, and the rubber crutch tip covers the rough end to protect swimmers.

1. Arm Maintains Tangency. A new phono arm imported from Britain keeps the pick-up axis tangent to the record grooves at all times, thus keeping distortion, wear and surface noise at a minimum.

Ordinary arms are truly tangent over only a small portion of their arc. Previous efforts to minimize this error have been to offset the head, curve and lengthen the arm. The B-J arm uses the pantograph principle. Twin arms alter the angle of the head to maintain tangency as it sweeps across. All pivots have needle bearings with hardened seats. Less than one percent tracking error is claimed with the self-aligning arm.

New for the Music Fan

2. Lengthens Tube Life. By lessening the thermal shock that tube filaments sustain when first turned on, this unit is said to lengthen their life. When filaments are cold, resistance is low and a heavy surge of current flows. The device compensates for this. Suitable for TV, hi-fi and other electronic equipment drawing 150 to 400 watts, the unit is attached by plugging it in between the outlet and the power cord.

METALLIC PLUNGERS working in low-loss dielectric sleeves are moved in and out by a threaded spindle to tune in FM stations.

3. AM-FM Set Needs No Antenna. Built-in antennas for both AM and FM enable this dual receiver to play wherever it can be plugged in. An exclusive coaxial tuner is said to provide exceptional stability, sensitivity and good FM lock-in characteristics, giving good reception even in poor signal areas. The set has seven tubes, selenium rectifier, 1½-watt amplifier and 6″ oval speaker.

4. Plays Mixed Stack. You can stack 7″, 10″ and 12″ records of the same speed on this changer for either automatic or manual play. An adapter also permits the playing of a 1″ stack of 45-r.p.m. records without individual center inserts. The arm returns to rest and the motor stops after the last record has been played.

Further information about the products described on this page can be obtained from: 1. Hi Fidelity Inc., 420 Madison Ave., NYC; 2. Wuerth Enterprises, 7819 Farnsworth St., Philadelphia; 3. Granco Products Inc., 36-07 20th Ave., Long Island City, N.Y.; 4. Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago.

MODERN CARPORT

Coming Next Month:

How to Give Your Home a New Look

SPORTS-CAR WEATHER VANE

A big special feature on practical, money-saving ways to give your home a new look—with full-color photographs and drawings—tops an all-star show of home-improvement ideas you'll find in the enlarged September* Popular Science Monthly. *It will pay you—many times over—to get in line early for this bonus issue, planned especially for do-it-yourselfers.

FIREPLACE FACE-LIFT

SLIDE-DOWN DOORS

STORAGE HEADBOARD

LIGHTED CORNICE

Glass Tricycle Is Lamp Display

LIGHT transportation is apparently what the young lady above goes for, although she won't travel far on that tricycle. Her daddy, a Westinghouse engineer, built it from fluorescent lamps to show variety of shapes and sizes available.

Hydraulic Arm Gives a Hand

THE tragedy of paralysis has been lightened for Marv Pulliam by men he used to work with at North American Aviation, Los Angeles, who built this hydraulic "Sabre Arm." Small movements of his left foot control arm direction; his right foot controls wrists and fingers.

How a Metal Detector Works

BURIED metal, whether it's a rusted tin can or a vein of gold, "sounds off" and discloses its hiding place to anyone carrying this apparatus.

The metal detector consists of a tiny radio transmitter and a receiver, powered by batteries and mounted at opposite ends of a 32-inch carrying handle.

The transmitter, using a fixed-loop antenna housed with it in the box at the rear of the handle, steadily transmits a signal with a frequency of 100,000 cycles. Most of the signal goes into the

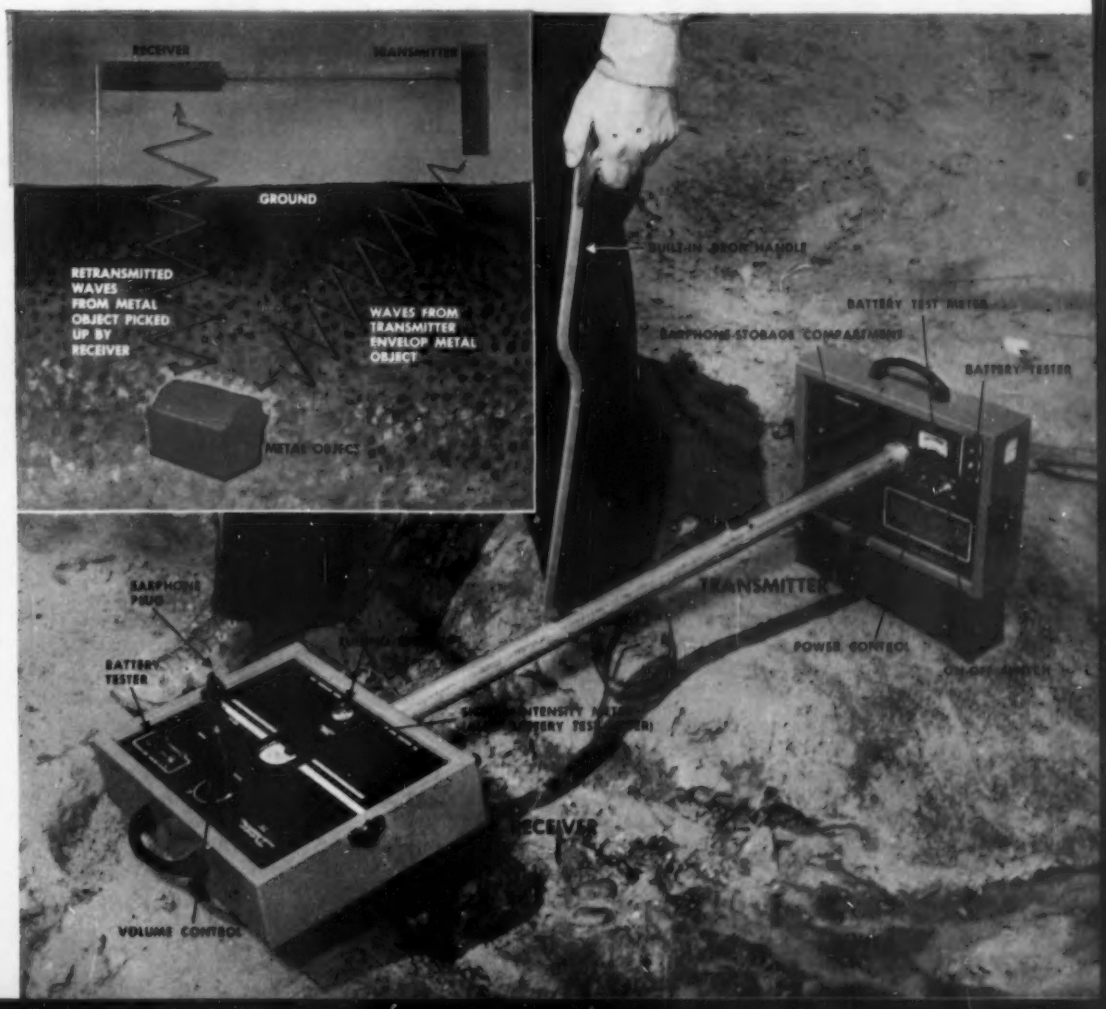
GETTING RID OF DIRECT SIGNALS from the transmitter, the operator turns a screw adjustment on the receiver. This changes the angle of the receiver's hinged loop antenna (below).

earth. If it encounters a metal object, the object becomes energized with the signal, like a tuning fork, and retransmits it towards the surface. The receiver picks up this retransmitted signal and converts it into a tone audible in earphones. The tone grows louder as the receiver is brought nearer to the buried metal. A needle on the receiver swings ever wider at the same time.

The receiver can pick up only one station—the one at the other end of the handle. The loop antenna in the receiver is placed at right angles to the loop in the transmitter. This is done in order to avoid picking up the signal before it has a chance to penetrate the earth.

This metal detector, one of several brands, is made by Detectron Corp., N. Hollywood, Calif.

RICHES OR AN OLD IRON POT may be the reward of the man with the metal detector, whose parts and function are shown below. The detector cannot tell what kind of metal it has found.



Wood Bit Drills Concrete

As an emergency substitute for a masonry drill, an old twist drill will do a good job if you turn it backwards between hammer blows. This digs out an even series of chips. Don't use a good drill; it will dull.—*Roy L. Clough Sr., Bristol, N. H.*

Cement Saves Hose Washers

To keep hose washers from falling out and getting lost, coat the inside surfaces with shellac or varnish, press them back in, then tighten the couplings together. Let them set overnight before running water through.—*Ted Otsu, Vancouver, B. C.*

Pick and Shovel Form Ramp

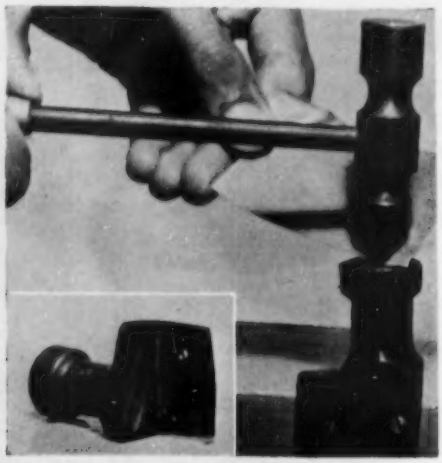
A pick and shovel make a quick ramp to slide heavy packages into or out of a car trunk. Slope the handles against the bumper and steady the tools by pressing them into the ground and bracing them with your feet.—*J. C. Scott, Kittery Point, Maine.*

Pipe Cleaners Spread Glue

You can make a handy glue spreader by drilling a hole in a dowel and forcing in several pipe cleaners. Leave the ends sticking out and twist them around each other.—*C. E. Clark, Middleboro, Mass.*

Pad Prevents Hammer Dents

A carpenter will sometimes carry a piece of leather in his pocket in case he needs a pad to put under a hammer when pulling nails. A piece of shoe sole or an old machine belt can be used.—*Clifford J. Bonna, Attleboro, Mass.*



Hammer Makes Bench Anvil

An old or inexpensive hammer head can be turned into a small bench anvil as shown above. First grind down the head to the shape in the inset, leaving a flange on one side. Drill two holes for screws and mount it face up on the edge of your workbench. —*O. S. McCollum, Vaux Hall, N. J.*

A. *Ball-Race Steering gets a workout on the "skid pad" at General Motors Proving Grounds.*

B. *The reduction in actual turning effort is measured by a recording wheel attached to the normal wheel.*

C. *A Chevrolet's front wheels are turned—with velvety ease—by these 54 micro-polished steel balls.*

"Here's why Chevrolet is easier to steer"

says Ed Cole, Chevrolet Chief Engineer

One thing that can rapidly turn driving fun into driving fatigue is heavy, stiff steering. This is a serious problem with modern cars, where so much of the weight is on the front wheels.

When we were designing the 1955 Chevrolet we attacked this problem in two ways: First, we moved the center of weight back to lighten the load on the front end. And then we incorporated Ball-Race steering, which substitutes the *rolling* friction of 54 micro-polished steel balls for the usual *sliding* friction.

If you imagine the steering column as a sort of giant bolt, the "threads" on this bolt are a closely packed spiral of those steel balls. When you spin the steering wheel the ball-bearing threads rotate inside a huge "nut" that is linked to the front wheels, pushing it down or up and thus turning the car.

That's how Ball-Race steering creates a manual system that comes awfully close to the ease of power steering—as you'll discover on your first demonstration drive. Why don't you sample it, soon, at your Chevrolet dealer's? . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

How filters can improve your pictures

Filters are to photography something like the finish you add to a piece of furniture. The bench or table you make will serve perfectly well without the finish. But with it, its beauty is greatly enhanced. And so it is with your pictures. Film does a fine job—filters help it do an even better one.

What is a filter and what does it do? Basically, it's a piece of scientifically tinted gelatin or glass placed over the camera lens. When photographing a scene on black-and-white film, objects in the scene, though colored to your eye, will come out in the finished print in many shades between black and white. These shades will come out more accurately, properly light or dark, with the assistance of the proper filter.

Notice how the use of a filter has improved the picture above, bringing out clouds and other detail in dramatic contrast. Made without a filter it would have appeared as in the smaller illustration.

In other words, filters make good photographs *better*. They put *you* in command, so to speak, of every picture you make,

and enable you to emphasize important details which otherwise might not appear.

What filters to select? While there are hundreds to choose from, a few will cover nearly all normal black-and-white picture-taking needs. In the table below are listed the Kodak filters that make a practical kit—together with the primary uses of each. You can buy inexpensive all-glass filters, such as the new Kodak Pictorial Filters, or for finest picture results, the professional-quality, gelatin-in-optical-glass Kodak Wratten Filters.

There are some very useful Wratten filters for color photography, too. One is the Kodak Skylight Filter (from $1.75) which is used for outdoor Kodachrome shots on hazy or overcast days, and in open shade to reduce excess bluish light for a warmer, more pleasing result. Others are the Daylight Filter (No. 85) which adapts indoor Kodachrome Type A Film for outdoor use (from $1.75), and the Flash Filter (No. 81C) which adds warmth to indoor Kodachrome Type A shots taken with Class M bulbs (from $1.75).

For more detailed information on color filters and their uses, ask your Kodak dealer for the Kodak Data Book, "Filters and Pola-Screens." ($.35)

KODAK FILTER GUIDE FOR BLACK-AND-WHITE FILMS

FILTER	SUBJECT	EFFECT DESIRED
Kodak K2 Wratten or Kodak Yellow Pictorial (with Verichrome or any panchromatic film like Plus-X)	Clouds against blue sky	Clouds emphasized, sky darkened
	Object or figure against blue sky	Normal contrast between object or figure and sky
	Distant landscapes	Slight haze reduction
Kodak X1 Wratten or Kodak Green Pictorial (with panchromatic films only)	Foliage	Lighter
	Portrait of person	Natural skin tones
	Clouds against sky	Clouds emphasized, sky darkened slightly
Kodak Wratten A or Kodak Red Pictorial (with panchromatic films only)	Object or figures against sky	Sky greatly darkened for dramatic contrast
	Distant landscapes	Reduces atmospheric haze

Kodak Adapter Ring—Slips over camera lens, holds any filter of same Series size. Comes in Series IV to IX sizes. From $1.35.

Kodak Wratten Filters in "B" Glass—In a wide range of colors for a variety of subjects. Series IV to IX sizes. From $1.75.

Kodak Pictorial Filters—Available in Yellow, Green, and Red in Series IV, V, VI sizes. From $1.50.

Prices are subject to change without notice

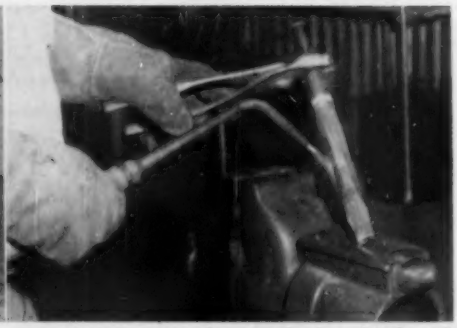
Eastman Kodak Company
Rochester 4, N. Y.

Kodak

How to Sharpen a Cold Chisel

BADLY CHIPPED, this chisel shown above is of no value. But it can be shaped and hardened for tough cutting like the one at the right. Using a neutral flame of a gas welding torch, heat the end white-hot and hammer it to shape on an anvil. Don't draw the edge too thin. If the head is mushroomed, grind it to a clean bevel.

SHARPEN THE EDGE on a grinder. Determine the cutting-edge angle by the type of work for which you'll use the chisel. The lighter the work the thinner the edge can be.

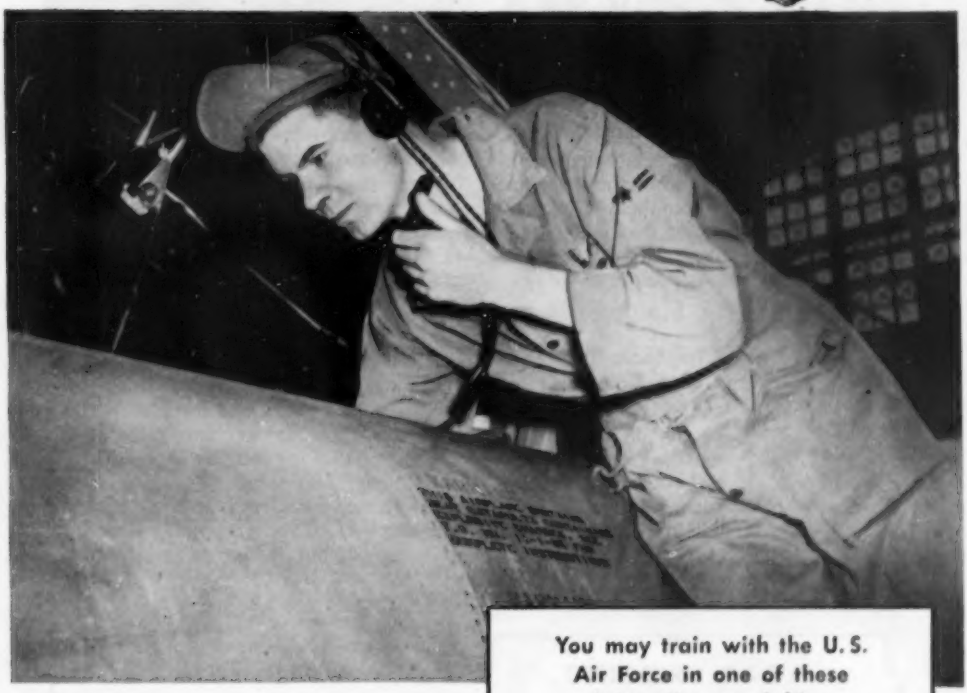


TO REHARDEN IT, first mark the chisel with chalk at the three-quarter mark. Then, holding it with pliers and using the torch, heat it white-hot below the mark to the cutting edge.

DIP INTO WATER to the halfway point of the heated area as soon as white-hot. Hold it at this point just three seconds—measured by counting aloud "one thousand and one, one thousand and two, one thousand and three." Have a piece of coarse emery cloth handy.

CLEAN ONE FLAT with the cloth. Watch dark-blue color flow toward cutting edge, with dark red, then dark straw, finally light straw ahead of it. Quench entire chisel just as light straw touches cutting edge. Let cool thoroughly. *—Harry and Keith Kerwin, Long Beach, Calif.*

Put your electronic skills to work



Young men who are interested in electronics, mechanics, or other technical specialties have an interest in the U. S. Air Force. As an Airman, you may have an opportunity to develop your technical ability and learn an interesting, exciting, and good paying skill. Act today and put your skills to work tomorrow. Put them to work where they'll do the most good... put your skills to work in the U. S. Air Force.

You go places – faster in the U. S. Air Force

You may train with the U. S. Air Force in one of these interesting specialties

Radio and Radar Maintenance · Missile Guidance Systems · Armament Systems · Weapons · Training Devices Maintenance · Wire Maintenance

M-10-PB

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Personnel Procurement Division
Box 2202, Wright-Patterson AFB
Dayton, Ohio

Please send me more information on my opportunity as an Airman in the U. S. Air Force.

Name_____ Age_____

Address_____

City_____ Zone____ State_____

Music Stand Holds Blueprint

A FRIEND of mine who specializes in electronics has found a solution to the problem of following a large, complicated wiring diagram while he is doing the actual wiring. He places the blueprint on a music stand beside his bench.—*Arthur S. Goodwin, Port Stanley, Ont.*

Paraffin Prevents Tool Rust

A BLOCK of canning paraffin kept in a workbench drawer will help you keep your tools from rusting.

When you finish using a tool, give its cutting edge a wipe or two over the clean paraffin. This not only protects the edge, but makes the tool easier to use the next time you take it out.—*Frank A. Javor, North Bergen, N.J.*

Lipstick Top Caps Crayon

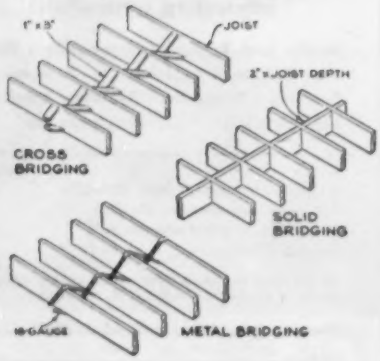
DO YOU carry a crayon on the job to mark crates, layouts and the like? A lipstick cap over the end will protect your pocket and the sharpened crayon point.

Asbestos Guards Power Cord

IN OUR shop as many as six men use the electric soldering iron, and a cotton-covered power cord quickly becomes frayed and sometimes badly burned.

To avoid this, we wrapped the cord tightly with asbestos cord, spacing the spirals close together. The wrapping takes time and patience, but it pays off.—*George H. Stade, Victoria, B.C.*

FLOOR BRIDGING



BUILDING codes require bridging between joists to strengthen floor construction. Minimum sizes usually acceptable are indicated in the drawings.

Locate bridging at intervals of 8′ or less. If the required joist depth is more than six times the thickness, bridge the joists at intervals not exceeding six times the joist depth.

Saw wood cross-bridging at the appropriate angle at each end. Nail with two 8d. nails at each end. Toe-nail solid wood bridging to the joists with two 10d. nails at each side. For metal bridging, drive one 10d. nail at each point of contact with the joists.

FOR YOUR POPULAR SCIENCE MONTHLY INFORMATION FILE

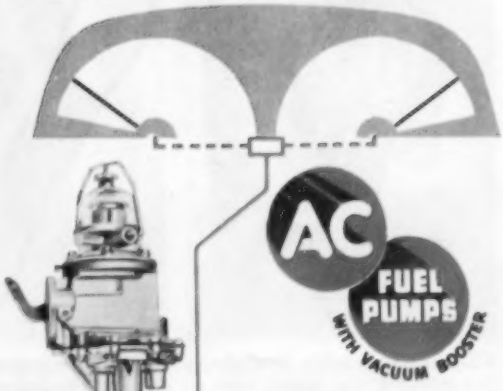
...Mr. Vacuum can help you to safer driving!

You need power—lots of power—to keep today's king-size windshields clear.

If your car is like the vast majority of cars on the road, wiper action depends on vacuum power. But, each time you step on the gas to pass another car on the road you need *extra* vacuum power . . . and with an AC Combination Fuel and Vacuum Pump you get it!

AC supplies a vacuum boost to keep wiper action steady, keep your windshield clear. And, you drive on through rain, storm, snow or sleet with greater visibility and greater safety—thanks to AC!

If you *don't* have an AC Combination Pump in your car, you need one. See your nearby AC dealer, won't you?



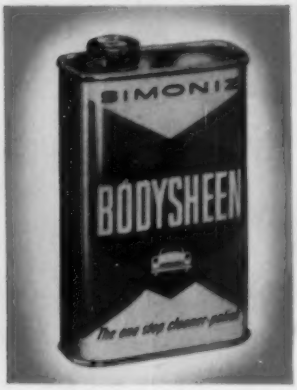
With an AC Combination Pump you can depend on steady fuel flow to your engine—and on stronger wiper action to give you clearer, safer vision.

GM GENERAL MOTORS

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

AC FUEL PUMPS ARE STANDARD FACTORY EQUIPMENT ON 9 OUT OF 10 CARS AND TRUCKS ON THE ROAD TODAY!

Wizard "Twin-Fire"® patented spark plug gives top performance twice as long as single electrode plugs. Each electrode fires one at a time while the other "rests", stays accurately gapped up to twice as long. Guaranteed 18,000 miles. Each, in sets.....**75c**



The one-step cleaner-polish! New Simoniz Bodysheen cleans and polishes, in one easy step. Just wipe on, then wipe it off! Brings out natural brilliance, enriches colors. Gives your car a long-lasting, weather-resistant finish. (3P7113).....**98c**

Guaranteed to fire in oil. Aldor Spark Plugs have bi-metallic thermostat control that keeps spark plug always at peak efficiency. Adjusts to any heat range requirement automatically. Special non-burning electrodes. In sets (AR1380-8).....**95c** ea.

New Power...New Beauty...

Over 40 Years...Headquarters

All-chrome portable spotlight has powerful 4½" sealed beam unit. Perfect for night car repairs, spotting street signs, etc. Plugs into lighter socket. Pistol grip handle, with built-in on-off switch. 6 volts. 10-ft. cord included. (3L6116).....**$5.59**

Don't be stranded by a worn-out fan belt. Replace now with a Wizard extra-quality Fan Belt. Inner core of endless rubber impregnated rayon cords. Tough rubber cushion reduces heat, assures long life. Can't slip, stretch. Guaranteed fit. (7P105-P209) **69c** up.

Get more miles per gallon with Pyroil "A". Gives heatproof lubrication. Reduces carbon, gum deposits. Lubricates upper part of motor. Pyroil "B" Crankcase Oil gives a cleaner engine—more power. Removes gum, sludge. Pyroil "A" or "B" (AR1336-7) Pt. **98c**

Wizard De-Sludge-Er oil filter cartridge has new 100% cellulose filter agent. Out-filters paper or cotton. Removes sludge-forming elements from oil. Won't clog, channel or by-pass. For all cars, trucks, tractors with full-flow or by-pass systems. From **$1.25**

Like a "tune-up"! For better engine performance the year around, add Casite to your motor oil with every oil change. Keeps engine clean. Gives you easier, faster starting . . . quiet, smooth power. Ideal for breaking in new cars. Pint, only (A1329).....**$1.00**

Wizard Fuel Pumps, guaranteed for long, dependable service. Original equipment replacement. Diecast body; precision machined surfaces and parts; fully tested. Extra high quality diaphragm for longer life, top performance. All popular cars. From **$2.45**

New Safety For Your Car At Western Auto

STORES AND ASSOCIATE STORES

For Top Quality Auto Supplies.

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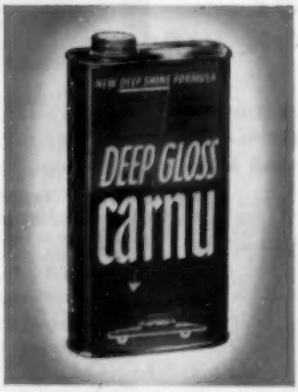
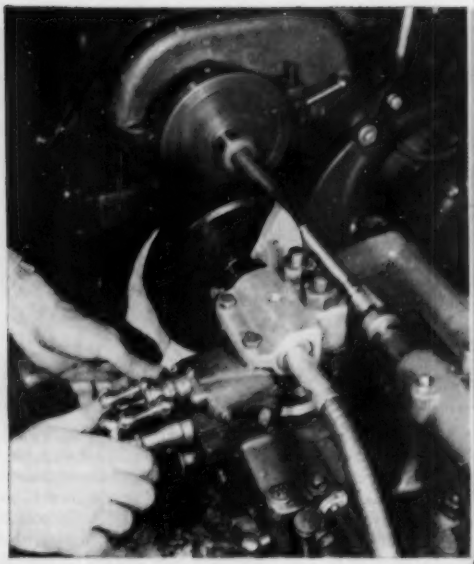
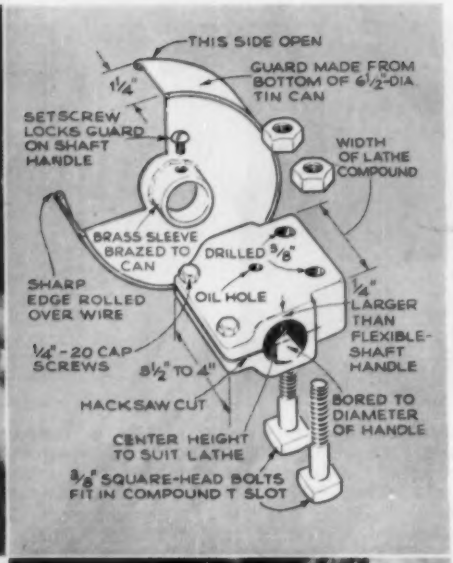
Chrome Exhaust Deflectors and Extensions add beauty to your car. Keep exhaust off bumper. Easy to attach . . . fit most cars. Western's Exhaust Deflector; simple, flared design (CR2006) **53c** Exhaust Extension (8" x 2½"); straight-tube type. (CR2007) **$1.19**



It cleans! It polishes! Johnson's Deep Gloss Carnu cleans as you put it on . . . shines to a hard, long-lasting mirror finish when you wipe it off. No tiresome buffing or rubbing. Restores deep down color. Won't harm finish 20-oz. can (307109).....**$1.65**

It's easy to repair brakes with Wizard Master and Wheel Cylinder Kits. Includes live rubber cups, boots; precision made valves, springs. For most cars, trucks. Master Cylinder Kits, less piston (S5020-48) from .....**69c** Wheel Cyl. Kits (S5105-28) from **37c**





Hitch a flexible shaft to your lathe, and you have a

Tool-Post Grinder for Less Than $2

By Phil McCafferty

THE inevitable tool marks on turnings can be ground smooth with this tool-post setup, leaving a mirror finish accurate to close tolerances.

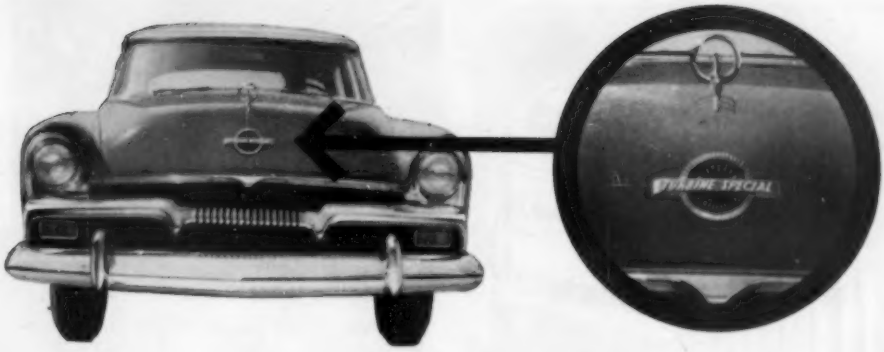
Make a solid-wood pattern for the shaft support and have it cast in aluminum at a foundry. Wire-brush the casting and file the bottom flat. Drill two ⅜" holes for mounting bolts and bolt the casting in position on the lathe compound. Chuck a drill in the headstock and drill an undersize hole through; then enlarge it to the diameter of the flexible-shaft handle.

Drill and tap holes for two ¼"-20 cap screws and hacksaw the front edge lengthwise to split the casting. Drill a ¼" hole through the top to coincide with the oil hole in the flexible-shaft handle.

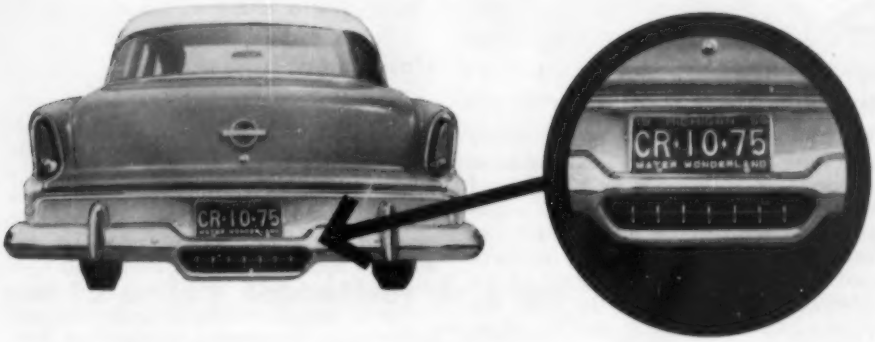
SPLIT THE FRONT SIDE of the casting with a hacksaw after boring a hole for flexible-shaft handle. Note shallow recess (arrow) to clear unmachined part of lathe compound.

Cut about 1¾" from the bottom of a heavy-gauge tin can for the guard. Remove a V-shaped segment and roll the sharp edges over a piece of stiff wire. Drill a hole in the center and braze a brass sleeve over it to support the guard on the protruding end of the handle.

Use 60- to 100-grit aluminum-oxide wheels, and rotate the work slowly.



This, Too, Is THE *FORWARD* LOOK



What's different about this Plymouth?

Two things are different. First, this is the one you can't buy. Second, it has a radically different kind of engine—the Chrysler Corporation *gas turbine* engine! This experimental car runs with no carburetor, no piston rings, no radiator, one spark plug and on ordinary fuel. Although there are years of research and testing ahead before it could be mass-produced, this prototype is in operation *now!*

This is one of many continuing research projects of THE FORWARD LOOK*. As each new advance is perfected, it will be made available to you . . . for it is the thesis of THE FORWARD LOOK to keep you ahead in car performance, in safety, and in styling.

You have only to see and drive the new Plymouth, Dodge, De Soto, Chrysler and Imperial today to know why these cars are winning such universal public acceptance. THE FORWARD LOOK is going full-speed ahead with new ideas, new designs, and a major program of expansion to keep up with your demand. THE FORWARD LOOK is on the move! Keep your eye on it!

**Engineers interested in this kind of advanced research & development, write to Chrysler Engineering, Box 1118, Detroit 31, Mich.*

CHRYSLER CORPORATION

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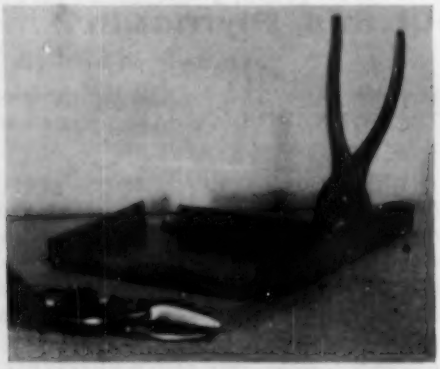
Tops in TV Drama—"Climax!"—CBS-TV, Thursdays

Angles Protect Radiators

CAST-IRON radiators were subject to breakage in a local shipping and receiving room when accidentally bumped by loaded hand trucks. To protect them, 1½"-by-1½" angle-iron guards were placed around each one as shown, with floor and wall supports. Guards were placed at the height of the hand-truck bumpers—about 10" on the average.—*John Morgan, Holbrook, Mass.*



Metal Brake Made from Pliers

FOR a bending brake to use with light metal, weld a 6" piece of tool steel to the inside of each jaw of a pair of pliers. As you bend the metal, a light hammer tap along the edge will give you a sharp bend.—*Edmund H. Marriner, La Jolla, Calif.*

Vise Jaws Will Cool Metal

To COOL small pieces of hot metal without quenching them in water, clamp them between the jaws of a vise, preferably a comparatively large one. The jaws absorb the heat. This trick is especially good where you are in somewhat of a hurry but the cooling process cannot be too rapid.

How to Apply Flat Paint

FLAT wall paint, unlike exterior oil paint, should not be applied with a spread brush. It is made to flow, and if you lay it off properly, a small square at a time across the wall with a full brush and semicircular or crisscross strokes, the flow eliminates brush marks. Don't touch a square again. The edge will stay wet until the next stretch has been coated in.

For a smooth surface prepare the wall before sizing by scraping, sanding and dusting to remove imperfections and grit that will show up under flat paint.

Loose Brush Handle Secured

A BRUSH handle won't wobble or pull out of its joint if you fit the end with the threaded brass base of an old light bulb and line the brush hole with a screw cup from a light socket. Secure both parts with wood putty. You probably will have to rebore the brush hole to make it large enough for the socket. *J. M. Finn, Pittstown, N.J.*

Texaco Tips On Car Care

← How to prevent engine misfiring

When dirt and moisture accumulate on the porcelain, spark plug functioning is often impaired. They can short out, cause your engine to misfire. To prevent this from happening, simply wipe plugs regularly with a dry cloth. Keep your spark plugs clean, and they will give you better performance.

How to enjoy smoother driving

Just treat your car to *Marfak* chassis lubrication. *Marfak* is super-sturdy . . . clings fast to vital points of wear and friction . . . seals itself *in*, seals *out* dirt, dust and road water. And *Marfak* protection is longer lasting! It gives you *cushiony* comfort for 1,000 miles or more. Get *Marfak* chassis lubrication today. See your Texaco Dealer . . . *the best friend your car has ever had.*

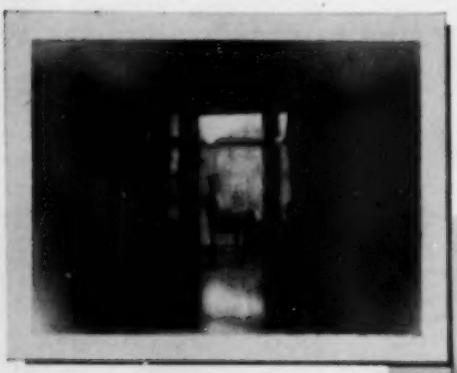
TEXACO DEALERS IN ALL 48 STATES

Texaco Products are also distributed in Canada and in Latin America

THE TEXAS COMPANY

TUNE IN: TEXACO STAR THEATER starring DONALD O'CONNOR or JIMMY DURANTE, on TV Saturday nights, NBC.

Pictures Made with Water Glasses



WATER-GOBLET LENS at right is moved back and forth to focus scene on the backdrop. This setup produced the photo above, a picture suggestive of photography's early days.

A WATER glass isn't an essential item of a photographer's equipment. But that's what experimenters used for two of the photos on this page. They dispensed with the usual camera.

To make the photo above, Chuck Anderson of Burlingame, Calif., set up a curved goblet and filled it with water to serve as a lens. An aperture cut in paper taped to one side of the glass sharpened the image.

After taping a sheet of extremely slow printing paper (Velite) to the backdrop, Anderson made an exposure of four minutes. When developed, this produced a paper negative which was used to print the picture.

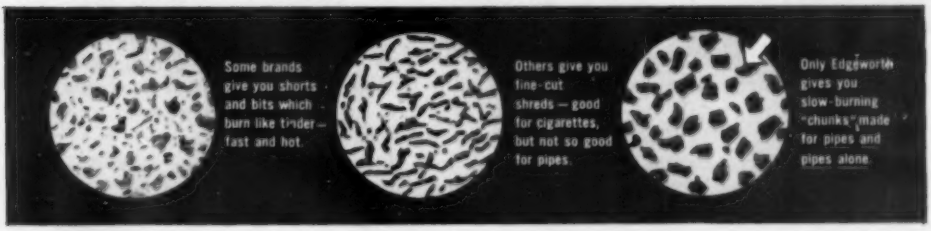
To make photos to decorate a nursery, Ludwig Aron of New York wraps a sheet of contact printing paper around a glass decorated with decalcomanias.

The paper-wrapped glass is then placed over a small electric bulb and exposed for a few seconds. The paper is developed in the usual way.

A DECORATED GLASS, wrapped with contact paper and then exposed over a small light bulb, gives you a design like the one below. Rubber band holds the paper on the glass.

Compare The Cuts Of Pipe Tobacco

See Why Edgeworth Smokes Coolest... Never Bites Your Tongue



Edgeworth's Way with White Burley Has Never Been Equalled

Your true tobacco expert will tell you that white burleys are the world's coolest smoking tobaccos. Edgeworth is a blend of white burleys only—aged like fine wine, for years. Other tobaccos use white burley, too—but nobody else has yet found out just how to blend and process tobacco to give it the even-burning, cool-smoking character that Edgeworth "Ready-Rubbed" has maintained.

What "Ready-Rubbed" Means to Your Smoking Pleasure

Old-time smokers knew the secret of cool, even burning. They carefully "hand-rubbed" their tobacco until it crumbled into chunks of just the right size. Now Edgeworth does all this for you *before* the tobacco is packaged. An ingenious, exclusive process "ready-rubs" Edgeworth into chunks that pack *right* in your pipe, giving you a cool, leisurely smoke with never a touch of tongue bite.

Made Right...Cut Right and Packed Right!

Three Months in a Duck Blind

A duck hunter left an unopened Edgeworth pouch in his blind for three months. When he discovered it, the tobacco was still mellow and cool smoking!

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FOR A COOL MIXTURE TRY HOLIDAY

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Get this guaranteed "Olde London" Pipe and two full-size pouches of Edgeworth tobacco for only $1.00. The pipe is fine, hand-rubbed imported briar . . . with genuine hard rubber bit . . . carbonized bowl for cooler smoking. If your dealer is unable to supply you, use this handy order blank.

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YOU'RE SMARTER SMOKING

Edgeworth

AMERICA'S FINEST PIPE TOBACCO FOR OVER HALF A CENTURY

Gus Slices Out of the Rough
[Continued from page 140]

sound it should have if gas was plentiful. He pulled the gas line and found a screen at the tank which was clogged with grass cuttings. With this screen and the carburetor cleaned, the motor started with the first turn. But it only fired a few times and died. Gus found himself frantically winding the starter rope around the pulley and yanking, while he fiddled with various adjustments. This thing, Gus told himself, has more tricks than a Toonerville Trolley—what's wrong with it now? He glanced at his watch. Six-thirty.

"Gosh-darn it," Abernathy complained, "you've got it running—keep it running. We'll be playing competition golf here in a little over an hour. Where is that fellow Bascom? I'm going in there and boot that telephone off the wall."

"Spin the engine for me, will you?" Gus said calmly, handing him the end of the starter rope.

ABERNATHY looked about despairingly, took the starter rope and pulled. Gus touched the top of the spark plug with the tip of a neon-tubed screwdriver. Brilliant flashes of hot spark shot through the tube as the motor fired several times, wheezed for several more revolutions and died.

"Ah!" Gus grunted. "I knew it had to be something tricky."

Bascom thrust his head out of a window of the clubhouse. "The doctor hung up on me," he announced loudly.

"Come out here, you nincompoop!" Abernathy bellowed back.

Like trying to concentrate in a madhouse, thought Gus, his eyes wary now. He had noted that the spark flashes in the neon tube had appeared only while the engine was actually firing. They had vanished as it wheezed to a halt. It seemed as if the spark had disappeared simultaneously with the last turn of the starter rope, as it left the starter pulley.

Gus took a look at the crankshaft bearings and found that they were badly worn and loose. As the breaker cam was on this shaft, the looseness, coupled with a worn cam follower, caused the points to open only when the upward pull on the starter rope raised the crankshaft up to the limit of its top bearing wear. As soon as the starter rope unwound from the pulley, the shaft dropped down to the bottom of the bearing wear, bringing the cam too far from the follower to open the breaker points. Thus, the motor fired only during the time when the starter rope was being pulled, exerting its upward pull on the shaft.

An over-close setting of the breaker points brought about a temporary repair. Gus quickly reassembled the parts, gave the engine a spin. It ran smoothly.

"All okay for now," he said.

"Thank heaven," said Abernathy.

AT THAT moment Bascom burst out of the clubhouse. "It's a boy!" he yelled. "Weighs eight pounds."

"That's wonderful!" Gus wrung Bascom's hand warmly.

"Congratulations!" Abernathy actually sounded as if he meant it. "Now would you please get this mower out on the greens before the boys begin to show up, Mr. Bascom?"

"I never expected," Gus told his helper, Stan Hicks, when they opened the Model Garage on Monday morning, "to hear Sam Abernathy call Tom Bascom 'mister,' or to say 'please' to anyone. That mower certainly had the old boy up in the air and all spraddled out."

"I'd like to have been there," Stan chuckled. "I hear Bascom called him out to the club at four o'clock. And he's got a temper like a caged wildcat."

"The best part of it," Gus said, "was that the more he howled and yelled the less attention Tom paid to him. He had about as much chance of competing with that baby as he would with a San Francisco foghorn. That darned lawn mower was as tricky a job as I've struck in a long time. I suspected everything but the main bearings." END

NEXT MONTH: Gus takes to water.

Headlight Beams Stay on the Road! Packard Torsion-Level Suspension keeps headlights steady and properly aimed for best visibility *regardless* of passenger or luggage load – an important safety factor in night driving.

Takes Sweeping Curves, Sharp Corners in Stride! Front and rear wheels are interconnected to give equal load on both outside wheels. You get a secure sensation of positive control on sweeping curves, tight corners with added stability and safety.

Takes Off at Ideal Ride Level! There's no rear-end "squat" to snap the neck or jar the spine when the *new* Packard takes off! The car drives forward evenly balanced and seat backs nestle more closely to passengers.

New PACKARD TORSION-LEVEL Ride

ELIMINATES CONVENTIONAL COIL AND LEAF SPRINGS

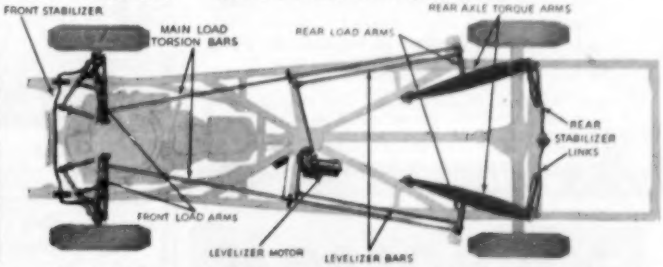
Smooths the Road . . . Levels the Load – *Automatically*

Long famed for creative engineering leadership, Packard has developed new Torsion-Level Suspension . . . hailed as the greatest ride development in automotive history . . . and here's why! In other cars, twisting forces due to vertical wheel movement are transmitted to the frame. Passengers are pitched and bounced, car body and frame are wracked.

With the *new* Packard, these same twisting forces are transmitted along the new Torsion Bar system, and absorbed *before* they can reach either frame or passengers. A power-controlled levelizer automatically compensates for changes in passenger or luggage load . . . keeps the *new* Packard always at ideal ride level.

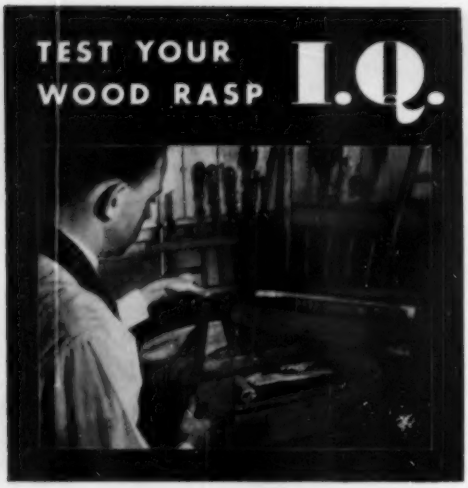
But to fully appreciate this new kind of ride, see your Packard dealer – Take The Key And See . . . Let The Ride Decide!

Just 7 seconds after load change, the unique levelizer automatically brings Packard back to ideal ride level.



Torsion Suspension is made up of two full-length torsion bars, four pivot arms and links. Driving torque arms connect rear axle housing to frame. The levelizer has two shorter bars connected by links and levers to a two-way motor.

PACKARD DIVISION • Studebaker-Packard Corporation



Q. What fine wood rasps are most useful to the home craftsman?

A. According to surveys by Nicholson File Co., the most useful rasps are: Flat, Half Round, Cabinet, Last Maker's and 4-in-Hand. (The 4-in-Hand is actually a versatile combination tool: half round and flat, file and rasp.)

Q. What brand of rasp does the home craftsman prefer?

A. Nicholson by 7 to 1 over the next leading brand, according to sales records and polls of brand preference.

Q. Why does the home craftsman prefer this brand?

A. Because he is sure of a *perfect rasp every time*. Durable, uniformly excellent Nicholson rasps are the product of 91 years of rasp-making leadership.

Q. What other Nicholson wood files or rasps are available?

A. Special purpose rasps include Round and Round Cabinet, Round Staggered Tooth. Nicholson also makes Flat and Half Round Wood files and Half Round Cabinet files, with teeth especially cut for smooth filing action on wood.

Send for Free 50-page Book, "File Filosophy," to learn more about the proper choice, care and use of files and rasps.

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(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON FILES *FOR EVERY PURPOSE*

How Strong Are Our Missiles?

[*Continued from page 129*]

lege degree—flies out along one line until it encounters an intersecting line that it recognizes. That's the target.

The second guidance system against fixed targets is termed self-contained. The missile is loaded up with all the information it needs to reach its goal, and it senses and corrects for any deviations from a path arbitrarily selected for it.

Finally, there is a semi-self-contained means of guidance for a missile. This bird requires a college post-graduate course. The missile gets its route and destination before take-off, and corrects its course by taking star-sights en route. The IBM will use this system.

Maps may be wrong. Making missiles go where they are supposed to is giving scientists gray hairs. One reason is the inaccuracy of maps. Missile men firing out to sea from one coastal test center discovered to their astonishment that island control bases, supposed to pick up the weapons progressively and pass them along, missed them entirely. The islands weren't where the maps said they were.

The suspicion exists that the spatial relationship among the world's continents on current maps may be wrong by hundreds or thousands of feet. Compound that for a bird fired intercontinentally and the result could be a wide miss.

One famous man of science, Clyde W. Tombaugh, discoverer of the planet Pluto, is under contract with the armed services to find an asteroid orbiting around the earth a few thousand miles out in space (PSM, Apr. '55, p. 138). A heavenly body that close could be used to align our maps to hairline accuracy.

Gravity has effect. Other problems bearing on missile guidance are manifold. Correct trajectories for long-range missiles depend in part on calculations of gravitational pull; and gravity varies considerably over the earth's surface.

Air currents, too, affect flight paths. And radio and radar frequencies can be jammed by the signal generators of a target nation. Gyroscopes mounted in one

[*Continued on page 220*]

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zoo cut-outs

For the kids' room. Animal cut-outs of Upson ⅛ Panels. A cinch to do with coping or jig saw. Fun to paint. Nail or glue up. Upson Strong-Bilt Panels make wonderful walls, too. They are crackproof, add lasting beauty to your home. FREE details yours, mail coupon today!

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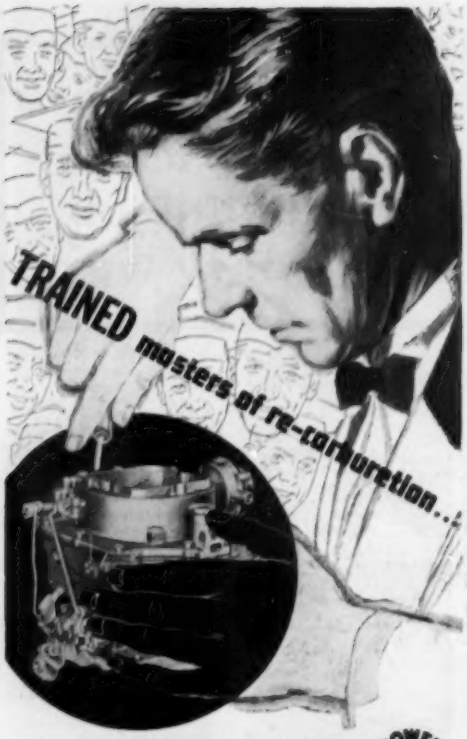

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How Strong Are Our Missiles?
[*Continued from page 218*]

kind of long-range missile will "drift," give inaccurate readings. So some missile research is devoted to better gyros.

As for the IBM Atlas—misnamed "ballistic" because it will be, in fact, guided—any estimate of when it will be perfected is the sheerest guesswork. Men conversing in strange tongues are worrying these days over "re-entry heats." By that they mean the friction heat generated when a missile of that kind peaks in

> ***The most valuable thing a man can have up his sleeve is a good strong arm.***
> —THE SIDEWALK SUPERINTENDENT

altitude at 600 to 800 miles above the earth and plunges finally into the air envelope of our sphere. It's enough to melt diamonds.

Lesson from World War II. The Germans lost a lot of their V-2s to simple friction heat in bombarding England. The things grew incandescent and blew up in the air. Today's missile experts will have to find better metals, or a means of cooling their weapons, or a way of slowing their speed at atmosphere levels, or perhaps a formula to burn off just so much of the encasing metal and no more. One thing under discussion now is a "heat sink," a place to deposit excess heat as a housewife disposes of dirty dishwater. The heat might, for instance, be absorbed by a fuel reserve.

Despite the problems, heroic strides are being made in missilry. In this country missile development is a "crash" program—everything is being poured into it. With a potential enemy in possession of the latest nuclear weapons, only a race to perfect missiles to carry them remains.

Of all our missiles, the antiaircraft Nike probably is the best right now. Its percentage of kills against drone aircraft on the practice range is fantastically high. But—let's face it—the Nike is a last-ditch weapon. If enemy aircraft ever get close enough to fall prey to the short-range Nike, we've all but had it. END

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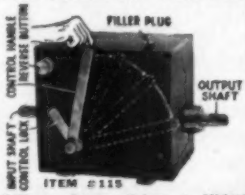
with FINGERTIP CONTROL



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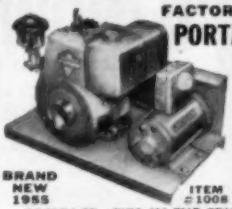

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Total head-feet	Speed	H.P.	GPM
25	3600 RPM	3	180
35	3000 RPM	1 1/4	90
20	2400 RPM	1/2	75

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[*Continued from page 109*]

tronic director has been down only three percent of the time. Much of this was due to a design defect now corrected.

Remote control, repetition of operations, saving in skilled manpower—these advantages of the MIT control system are important. But what makes the industry really happy is that it can do a run-of-the-shop job faster and better.

Up to now, automatic machine tools have been either very expensive special machines that make one part and no other or general-purpose machines that must follow a costly model or template. A skilled operator must still handle some controls and determine running speed.

Makes any part. The tape-controlled machine can be used for any part, not just one. There is no expensive process of modelmaking. And the final run is at high speed, completely automatic and completely accurate.

Making a particular airplane part by conventional methods requires 27 hours for set-up and a 169-minute milling operation. Making the same part with tape controls requires 16 hours for tape preparation, two hours for set-up, and a 39-minute run. For any re-run the tape preparation would be eliminated, and the saving would be 27 hours and 10 minutes!

Standardized components and circuits can be expected to trim the cost of the MIT system sharply on production models. Even so, the computer for the director is unlikely ever to become exactly cheap. Fortunately, however, one director can control as many machines as desired—and at any distance. Thus a director is not needed for each tool.

But what really takes Numerical Control out of the millionaire brackets is the fact that the electronic signals produced by the director can be recorded magnetically. Any machine fitted with the necessary servocontrols—far less costly than a director—can use this magnetic recording to direct its movements. Thus a machine owner who can obtain record-

[*Continued on page 224*]

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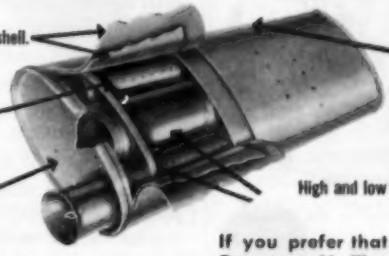

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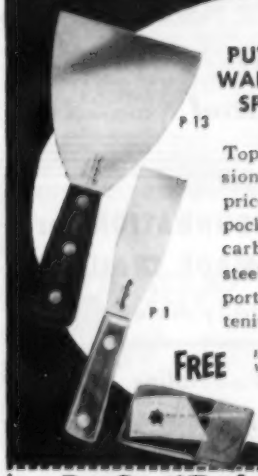
Red Devil



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Top-quality professionally-styled at prices to suit your pocket-book. High carbon, tempered steel blades — imported hardwood or tenite handles.

FREE How to Fix Broken Windows. Illustrated instructions on cutting and replacing window panes.

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Please send FREE copy of "HOW TO FIX BROKEN WINDOWS."

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STOP SAGGING REARS!

with LOW-COST

AIR LIFT PNEUMATIC SPRING BOOSTERS

Car got that "middle age spread" look? Even new cars need help for overloads of luggage, equipment or extra passengers. AIR LIFTS fit between leaf springs and frame — inflate with air to support overloads up to 1000 lbs! Perfect for vacation trips, and so easy to install. See your dealer or write for his name.

Most Models $20

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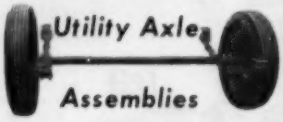


Utility Axle Assemblies

Model 1-UCO, shown, features 1½" solid steel axle, loads 2500 lbs. Comes completely equipped, except for tires. $65.29 postpaid (when paid in advance). Many other models. We manufacture a complete line of trailer axles, couplers and jacks . . . tell us what you need!

HAMMER BLOW TOOL CO.

WAUSAU 14-H WISCONSIN

Teaching Tools to Run Themselves

[Continued from page 222]

ings doesn't even have to own a director.

And soon it will be possible to convert ordinary non-automatic machines to tape controls at minimum cost. Work tables will be made with all three feed mechanisms, and all servocontrolled. The cutting head itself can be fixed in place.

Thus the uses of automatic controls are not likely to be limited to the big boys of industry. Medium-sized concerns that don't want to make a big investment in a director-computer will be able to send a blueprint to a computer service center. Back will come a custom-made recording of the product that can be plugged right into a machine. Such computer service centers already exist.

Big mass-production industries like auto making will find plenty of uses for Numerical Control. It can mean more frequent changes in models—and more specialized types such as sports cars and sportsman's wagons. Today the body dies for each model require an expensive process that starts with clay models, proceeds through a series of carved wooden replicas, and is climaxed by a steel die practically worth its weight in gold. With Numerical Control, there will be a far smaller investment to be paid off.

Plane makers have long been eager to utilize automatic machines, but the production run of a typical aircraft part is too short to pay off the big cash investment needed for the specially built, one-purpose type. Tape controls provide automatic machines that can do many different jobs. A whole family of such machines is being developed by aircraft builders and machine-tool companies.

Some experts predict that rocket-plane parts of the near future will be beyond the ability of human machine operators to turn out. It will be automatic tools or nothing. END

Auto-Suggestion

The sign which contributes most to safe driving is the one on the side of the car that reads "Police."—*Hudson Newsletter.*

Get Yourself FIXED FOR LIFE in the Big Pay Shoe Business!

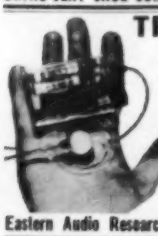
I'll put up the money to Give You a Flying Start!

It's no trick at all to make big money—FULL OR SPARE TIME—with America's most comfortable shoes! Amazing new "Spring-Step" cushion design proves it by actual demonstration. Only ORTHO-VENT has it! There is no other shoe in the world like it. Repeat orders are sure . . . steady . . . one try and a customer is sold for life. Profits are BIG. Orders are sure and easy with the most amazing 3-minute demonstration in the history of the shoe business. No experience needed. No investment to make. Everything, including one of the finest sales outfits in America today, with actual cut-a-ways, furnished free! Be the big-pay ORTHO-VENT man in your territory. Write TODAY! E. C. Brand, Sales Manager.

I GIVE PRODUCERS THEIR OWN SHOES AS A BONUS!

ORTHO-VENT SHOE COMPANY Dept. 458, Salem, Va.

TRANSISTOR RADIO!!!



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World's smallest and lowest priced transistor set. Perfect for baseball fans, office workers, children. Polystyrene plastic case smaller than cigarette pack, carry in shirt pocket or purse. Tunes all stations. Operates one month on two pen cells. Plays indoors, outdoors, at beach, on boats. Ideal emergency portable for Civil Defense stations. Assembles quickly. Complete with battery, less earset—$12.00. Precision 8,000 ohm hearing aid earset—$4.00. Postpaid. Cash, Check or Money Order.

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Your buying guide for finest kiln dried domestic and rare imported woods, inlays, beadings, matched plywood, mouldings, ornaments, etc. Biggest selection of tools and hard-to-find hardware. Packed with scroll saw patterns, projects, wood facts and money making ideas. Enclose 25c (refunded on first order) to help pay mailing and handling costs. Write today to

CRAFTSMAN WOOD SERVICE CO.
2729 S. Mary St., Dept. U-E Chicago 8, Ill.

PORTABLE JIG SAW

CUTS AS FAST AS SAWS COSTING $50 AND UP!

Does work of Jig, Keyhole, Coping, Band, Rip, Hacksaw. Has built-in **air blower**, fits any ¼" drill, cuts wood, plastics, metals. Incl. blade. At your dealer or try it on our **10-day trial.** Send check, M.O. (Postpaid). C.O.D.'s—postage extra.

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Dept. PS-8, 140 W. B'WAY., N.Y. 13, N.Y.

CUT BUILDING COSTS ⅔

Make Your Own Concrete BLOCKS and BRICKS To Use or Sell

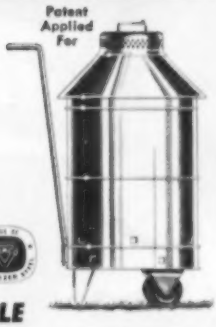
New superior moulds make absolutely square, true, easy-to-lay blocks which will pass any building code. Production is fast . . . easy. One durable $30 machine will make four 5"x8"x12" blocks per minute—1,000 a day. Pays for itself in one day! Sell blocks for big profit . . . or save ⅔ building cost for yourself. POST CARD BRINGS FREE FOLDER.

ECONOMY MFG. CO.
DEPT. 5 STONE MOUNTAIN, GA.

NEW, DUAL-PURPOSE APPLIANCE

IT'S A BAR-B-Q

Patent Applied For



IT'S A PORTABLE

BLITZ-BURNER (TRADE-MARK)

FOR HOME, LAWN, GARDEN WASTE

The new aluminized steel Blitz-Burner is the cleanest, safest, most efficient outdoor appliance ever designed for the collection, storage and disposal of waste basket contents, leaves, etc. (Not an incinerator.) Can be quickly converted into an attractive barbecue . . . simply invert the dome to seal off inside of container and insert low-cost charcoal burner and grill accessory!

STAYS GOOD LOOKING FOR YEARS!

Made of rust and corrosion resistant Armco Aluminized Steel. Special combustion dome induces fast, complete burning . . . eliminates flying ash . . . reduces smoke. Rolls easily wherever you want to use it on rubber-tired wheels. Burns safely anywhere! You need not scorch your lawn or driveway! For FREE Barbecue Cap, complete details and special introductory offer

MAIL COUPON TODAY!

MONTAMOWER DISTRIBUTING CO. (MFR.)
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Gentlemen: Please rush FREE Barbecue Cap, full-color illustrated literature and special introductory offer on your new Blitz-Burner.

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If you have a saw

Do as carpenters do—fill all cracks and saw marks with smooth-finish Plastic Wood. Plastic Wood handles like putty and hardens into real wood.

YOU NEED "PLASTIC WOOD"®

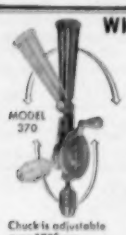
Favorite of home owners and craftsmen for 20 years! SPEEDY SPRAYER gives your work that professional paint finish everyone admires. Sprays paint, enamel, varnish, lacquer, etc. . . . 4 to 7 times faster than hand brushing! Lightweight, portable, uses any ¼ H.P. motor. Improved diaphragm principle assures clean, oil-free air. You'll find dozens of time and money saving uses for SPEEDY SPRAYER, including spraying insecticides 2-4-D and DDT. Complete outfit, without motor, only $36.50

$36.50 Less motor

At leading hardware, lumber, and auto supply dealers.
FREE—*write for handy booklet "How to Spray."*

W. R. BROWN CORPORATION
2637 N. Normandy Ave. • Chicago 35, Ill.

WHAT! ANOTHER "GIMMICK"?



Chuck is adjustable over 270° arc.

Handle moves in 180° arc at right angle to chuck.

No Sir!...it's a practical and mighty useful tool — the new PROTO ALL-ANGLE DRILL — a "must" for mechanics and hobbyists.

Not only one of the best straight drills on the market—the new PROTO ALL-ANGLE DRILL is a real "must" for your tough drilling problems. ¼" chuck capacity with long storage space in handle for your high speed drills. DON'T MISS THIS!

Order No. 370 ALL-ANGLE DRILL at $4.95

For prompt PREPAID (in U.S.A.) delivery, send check or M.O. to JAY-DEE SALES CO., 3302 No. San Fernando Blvd., Burbank, Calif.

Send 10¢ for 68-page PROTO TOOL Catalog — or no charge on request with your order.

For Racing at its Thrilling Exciting Best . . .

JUNIOR MIDGET

Get in on Micro-Midget racing, America's newest, most exciting, and fastest growing sport. Speeds up to 30 M.P.H. on a 1/10 mile track. Can be purchased in kit form or complete ready-to-run. Send 25 cents for completely illustrated literature describing all details.

Now available, the HANDBOOK for SMALL RACING CARS. This handbook is the most complete of its type ever published and has the information, specifications, and factory plans, specifications, and technical data on Micro-Midgets, for Jr. Midgets, Sprint-Midgets, Sr. Midgets, and 500 C.C. Cars. Only $1.00

COMET MANUFACTURING CO., Dept. 26, P.O. Box 1882, Sacramento 9, Calif.

He Built a Play Town

[*Continued from page 136*]

Santa's Workshop at North Pole, N. Y. (PSM November '49, p. 145). Other showplaces such as Old MacDonald's Farm in the Adirondacks and Adventure Town at Alexandria Bay bear his mark.

Even while designing these places, Monaco dreamed of the one he would like to build—one in which grownups would feel like kids again, and kids feel grown-up. The Land of Make-Believe came true when two old friends, Don Cameron and his daughter Kay, offered to become his partners.

Monaco asked the townspeople to a coffee-and-cake town meeting to explain his plan. Most were for it (the few who weren't have since become supporters). Work began in September 1953, and the village opened the following June.

> ***Some of the most heated highway discussions are started by accident.***
>
> —THE SIDEWALK SUPERINTENDENT

He's all for the kids. Monaco spends much time roaming the place while children enjoy themselves. To parents who try to enforce a hands-off policy, he soberly states he'll have to lay off help if nothing is broken. He may drop free tickets near children who haven't the price of a train or stagecoach ride (an 80-cent admission covers all but rides).

This dodge didn't seem possible in the case of three children looking longingly at the stagecoach. It was plain that their father had spent all he could afford. Monaco bundled them all in. "You're in luck," he said. "You're just in time for the one free ride we have every day."

He'll go further than that. As he was walking around in colored shirt and work trousers, one tyke asked if he were a real cowboy. Monaco shook his head in appropriate sorrow, whereupon the little one almost broke into tears.

Manfully Monaco reversed himself, said he was a cowpoke, and from Texas to boot. The fib saved the day and sent the little customer away happy. END

SUPER-LIGHT LEVEL
HAS MAGNIFIED VIALS!

EMPIRE ACRA-LITE No. 1521

A craftsman's dream! Acra-Lite Magnesium Level is ONE THIRD Lighter — for easier, faster handling. Easier to read, too. Super-accurate vials have "Full-Vue" *magnifying* cover plates. Get YOURS today — at your dealer, or order direct.

New Empire Acra-Lite Magnesium Level No. 1521, 24" Only **$6.70** 28" **$7.60** 48" **$13.50**

EMPIRE LEVEL MFG. CO.
10930 W POTTER RD., DEPT. PS, MILWAUKEE 13, WIS.

DO MORE PLANING JOBS WITH LOW COST BELSAW

LOW DOWN PAYMENT EASY TERMS

Exclusive MONEY-MAKING Features: • Full 12¾" x 6" capacity • Power feeds at 24' a minute • Provides for Grinding Knives in the Cutterhead • Attachments for Jointing, Rabbeting, Tongue, Groove, Matching. Convert low cost rough lumber into high priced cabinet finished stock . . . Easy to make flooring and popular patterns. Send today for free literature and prices.

Belsaw Machinery Co., 2066 Field Bldg., Kansas City 11, Mo

CUT RADIO CHASSIS HOLES IN 1-1/2 MINUTES OR LESS

Quickly make accurate round, square, key, or "D" openings . . . in metal, bakelite or hard rubber . . . with GREENLEE Radio Chassis Punches. Simply turn with a wrench. Many sizes. Write for details. Greenlee Tool Co., 2128 Columbia Avenue, Rockford, Illinois.

GREENLEE

YOUR TICKET TO THE ATOMIC ERA

Write today for FREE valuable literature from the world's leading supplier of Strategic Metal & Mineral Detectors. RADIAC's descriptive literature will open up a new profitable field for all Treasure-Seekers and Prospectors. There are Geiger Counters, Scintillation Counters, U-V Lights, Electronic Mineral Detectors & Dip Needles for URANIUM, OIL & STRATEGIC MINERAL PROSPECTING. Electronic Metal Detectors for finding Buried Treasure and locating, tracing buried pipes, cables, etc. These wonders of modern electronics may mean a fortune to you.

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ELECTRIC WELDER

AC or DC 110 Volt

The "Little Marvel" all-metal welder. 5-year written guarantee. Welds 1/16" metal or money back. Repairs tanks, tools, fenders, machine parts, etc. Complete with everything—rods, unit, eye shield, directions. $6.45 plus 50c postage. Flame torch accessory for soldering, cutting, brazing $3.95 complete with carbons, brass rods, flux. $2.00 deposit on C.O.D. ¼ inch Transformer Welder $19.95 F.O.B.

$6.45 Complete

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VARIABLE SPEED HYDRAULIC POWER TRANSMISSION

It has Infinite Speeds 0 to 550 Reverse Automatic Overload Protection: Adjustable Torque up to 180 inch pounds. ⅝" Input and Output Shafts. It will handle ¼ to 1½ H.P. Motor. Case measures 7½" long 7" high 6½" wide. VALUE OVER $300. Shipping Wt. 25#. On C.O.D. Orders we require a 10% Deposit.

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DIRZUIS MACHINE SHOP "Q", 1423-25 52nd Ave., Cicero 50, Ill.

Porter-Cable
Quality Electric Tools

BE COMFORTABLE WEAR Tom Long HOBBIES

You feel so free and easy in the comfort of Tom Long casuals

SLIDE into a pair of smart "hobbies" and a Tom Long sport shirt and you're set for any task, indoors or out. Hobby pants in various colors of rugged sport denim have extended waistband, adjustable side tabs for waistline comfort and deep, strong pockets. Designed and reinforced for long wear, styled for good looks and priced so you can invest in several outfits. Try out Tom Longs next time you purchase.

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10 New DELTA HARD COVER BOOKS

"How To Get The Most Out Of" your Power Tools. Clearly written, illustrated. New projects, ideas. Write for FREE descriptive folder: Delta Power Tool Division, Rockwell Manufacturing Company, 504-H North Lexington Avenue, Pittsburgh 8, Pa.

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HAVE WATER WHEN YOU NEED IT.

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Heavy duty model, for 6" casings, available with gasoline engine, at $1295 F.O.B. factory. Prices and specifications subject to change without notice.

CON-SOL

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WEST CHESHIRE, CONNECTICUT, U.S.A.

If your car's dip stick repeatedly shows you need to add oil, your power is fading . . . and it's

time to replace your Piston Rings!

Having to buy too much oil and gas, and slow pickup reveal POWER FADE! Your rings are badly worn—you're wasting money on lost power.

Top performance is gone. And despite the extra oil used, vital engine parts remain starved for oil. This is not only costly and wasteful, but is a warning of expensive repairs to come later.

See your motor specialist for a ring check-up. If he recommends a ring change, it will pay you to install Hastings *replacement* rings. They're engineered exclusively for worn engines to quickly stop power fade, oil-pumping and gasoline waste.

All the safety and driving enjoyment of full-powered performance are yours again with Hastings Rings . . . it's the best money you can spend on your car.

HASTINGS MANUFACTURING CO., HASTINGS, MICHIGAN
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Piston Rings, Casite, Oil Filters, Spark Plugs

* TOUGH but oh so gentle

HASTINGS

STEEL-VENT PISTON RINGS

Regular or Chrome-Faced

*** TOUGH on oil-pumping • GENTLE on cylinder Walls**

Now You Can Drive Better at Night

[*Continued from page 95*]

the second run, anticipating the hazard, the driver could see the figure just twice as far away.

How important to you is the lengthened seeing distance the new head lamps afford? Here's an example:

With the old head lamps an alert driver using his low beam can see a pedestrian 250 feet away at 50 m.p.h. At that speed he needs 258 feet in which to stop. The pedestrian's life is in serious danger. With the new lamps, seeing distance at that speed is 330 feet—leaving a clear margin of 72 feet.

That doesn't mean, however, that it's always safe to drive 50 m.p.h. Glare from approaching low beams can cut your seeing distance by one-third, and the dazzle of a high beam can cut it by 75 to 80 percent.

New lamps reduce glare. The new lamps help some in reducing this glare from opposing cars, particularly at the passing point. There is a tiny shade over the low-beam filament that cuts off much of the up-shining light that causes glare.

You can prove for yourself in your garage how this shade controls stray light. You'll need one old-style sealed beam and one new one on your car. Hold a cardboard horizontally about six inches above and just in front of each lamp in turn. The old lamp will cast a shadow of the cardboard on the garage ceiling; the new lamp won't. Then hold the cardboard vertically to one side and slightly in front. You'll see light reflected from the cardboard with the old lamp but not with the new.

The filament shade, by controlling stray light, also helps the new head lamps pierce murky atmosphere like fog lamps. You have noticed in fog that you see better with less light. That's because stray light from the old lamps is reflected back by the particles of moisture in the air, creating a screen of light. In the new lamp the shade redirects practically all stray rays.

You can buy the new lamps almost

[*Continued on page 230*]

NOW—THE QUICK-WAY TO SHARPEN ALL CIRCULAR SAWS

NEW

Model PG-12 Complete No extras to buy. $16.50 Postage Paid

Model PG-12 sharpens, joints, gums, and retooths all cross cut, rip, combination, miter, and planer blades up to 12" in diameter. Two precision index plates give versatile, accurate sharpening. Guarantees precise spacing of teeth. New safety rest prevents tilting and gouging of blade. Save time and money. Special $3.00 grinding wheel also included for use on your own power table. Fits regular or radial swing tables.

Order today. Send check, cash, or money order. We pay postage.

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1,001 USES—HOUSE, GARDEN, FARM
Original All-Purpose Pump has 3,000 GPH capacity, 450 GPH 80' high; or 1800 GPH from 25' well. Use any 1/6 to ¾ HP motor. Stainless steel shaft. Oil-less bearing. 1" Inlet; ¾" outlet. Motor coupling included.

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Postpaid if cash with order. (West of Miss. add 50c.) MONEY BACK GUARANTEE. Larger Centrifugal Pumps and Gear Pumps in all sizes.

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TOOL AND MECHANICAL DESIGNERS TEMPLATES

Made of Transparent Plastic

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3. **HANDKNOB.** 8½" by 11"—.025 thick. Nine sizes. **$2.50.**

Sent postpaid. No C.O.D., please. (Calif. res. add usual sales tax.)

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24-PAGE ILLUSTRATED DO-IT-YOURSELF PROJECTS BOOK

Describes attic finishing, built-in cabinets, add-a-room, recreation room, kitchen remodeling, summer cottage and farm projects. Contains helpful information on how to get started, planning, cost estimating, materials purchasing, and proper procedures, also nail charts, moulding designs, etc. Send only 25c and also receive FREE 52-PAGE POWER TOOL CATALOG.

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944 Central Avenue — Toledo 6, Ohio

Build Your Own OUTDOOR FIREPLACE

You can enjoy luscious steak fry, roasts and barbecues economically in your own backyard with the revolutionary new ROSTRO "Build-It-Yourself" grill unit. Information FREE—or send a dime for six ornamental outdoor designs and 75 delectable outdoor cooking recipes. Dealer inquiries invited.

ROSTRO SPECIALTIES CO. Coldwater 2, Michigan

24" ATTIC FAN KIT

Easy to assemble. Belt-driven. Blade, shaft, 2 self-aligning bearings, 2 pulleys, 2 collars, and V-belt. Everything you need, except frame and ¼-hp. motor, to make your own house cooler.

ONLY **$9.95** SAVE $46.00

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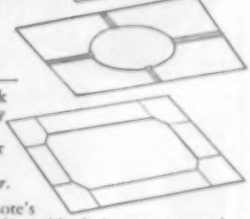
Free Prospecting Information! Latest News and Data on Equipment and Methods.

MINERALIGHT locates uranium, tungsten, zinc, mercury, zirconium, and other valuable minerals. Shows traces other responses miss. FREE information packet on ultra-violet MINERALIGHT plus latest data on Geiger counters and scintillation counters. Write Department SC-8, Ultra-Violet Products, Inc., San Gabriel, California.

Compare Your Ceiling with Your Floor



With parquetry, rugs, tile — the floor is part of your decorative scheme. The ceiling was once decorative, too. Then, the old materials became too expensive.

Today we have new materials—easy to handle—and the ceiling comes back into its own. An attractively paneled ceiling is something you can build for yourself—in a new home or *right over the old plaster.*

Take advantage of Homasote's Big Sheets—up to 8' x 14'—with their great strength, their insulation and sound-deadening properties. Homasote saws, nails, works easier than wood. Cut the Homasote to your own design. Have a recessed center panel; bevel the edges; cover the joints with molding.

Three well-illustrated folders with 18 valuable *make-it-at-home* ideas are yours for only 10¢—ideas for furniture, attics, basements, pools, etc. Mail the coupon today.

MAKE IT AT HOME—WITH HOMASOTE

HOMASOTE COMPANY
Department H-3, Trenton 3, N. J.
I enclose 10¢ for 3 Make-It-At-Home Folders.

NAME .....
ADDRESS .....
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My lumber dealer is: .....

Now HULL AUTO COMPASSES IN NEW CAR TONES

You can now select a Hull Auto Compass that matches or blends with the sparkling, bright pastel color of almost any new car! Most beautiful and useful accessory on the market. Guaranteed. At better dealers everywhere. Write for literature.

THE FAMOUS NAME IN AUTO COMPASSES

Beaconlite ILLUMINATED $6.95
STREAMLINE NON-ILLUMINATED $4.95

HULL MFG. CO. P. O. Box 246, E-8 WARREN, OHIO

NEW! PERSONAL POCKET RADIO

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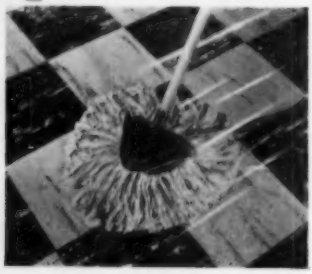

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Now You Can Drive Better at Night
[*Continued from page 228*]

anywhere. There are six brands: General Electric "All-Weather," Eveready "All-Weather," Westinghouse "Safe-T-Beam," Tung-Sol "Vision Aid," Electric Auto-Lite and Guide Lamp. All of them meet the same standards, but are not identical. Westinghouse, for example, puts a shield over both the high-beam and low-beam filaments.

Can you install the new lamps yourself? Certainly. It's a screwdriver job. But don't forget to aim them properly (PSM, Jan. '55, p. 177).

How to use your lights. With new head lamps or old, here are the experts' tips for getting the most out of them.

- Use your high beam on the open road—but hit the dimmer button when an oncoming car is 1,000 feet away.
- Don't dim *too* soon.
- Don't stare at oncoming headlights. Concentrate on the right edge of the pavement.
- Keep lenses *clean*.
- Check the aiming of your headlights twice a year—and immediately after any bump on a front fender. More than half the cars today have headlights incorrectly aimed, according to one authority.
- Don't overdrive your headlights! END

—*Public Safety magazine*

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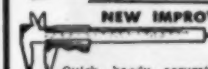

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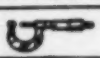

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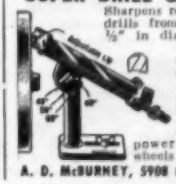

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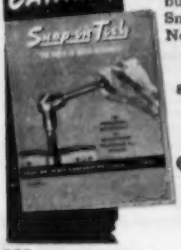

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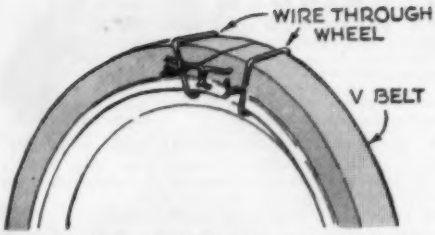

Wagon Tires Made of V Belts

Old V belts make good tires for a child's wagon. Lay the belt in the groove around the wheel and cut off the overlap. Miter the ends and wire them to the wheel.—*Donald Fortune, Grandview, Wash.*

Filler Fixes Worn Screw Holes

You can reset a screw in a stripped hole by filling the hole with plastic crack filler, pushing the screw in halfway, and letting it set overnight. Then refill with filler and drive the screw all the way in. —*Roy L. Clough Sr., Bristol, N. H.*

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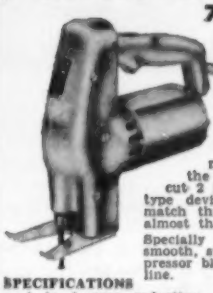

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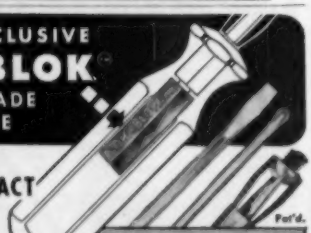

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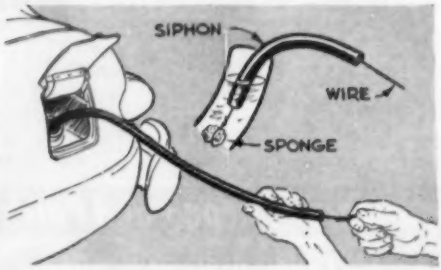

Sponge Speeds Siphon Action

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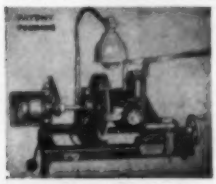

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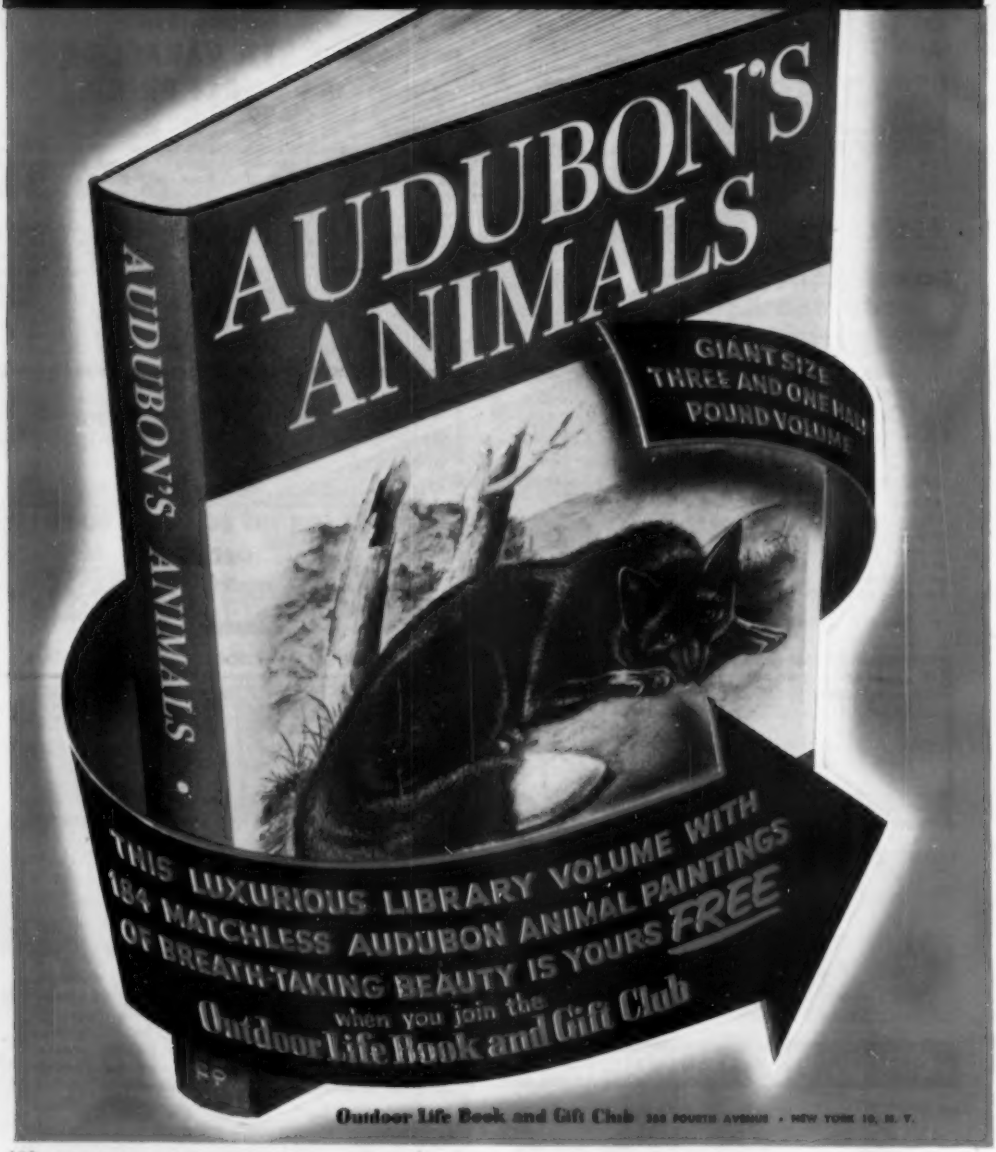

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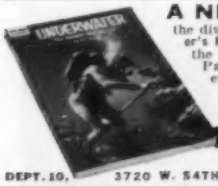

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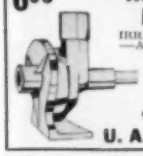

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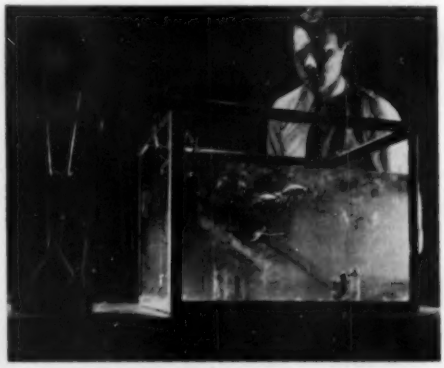

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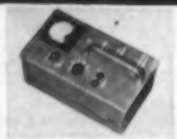

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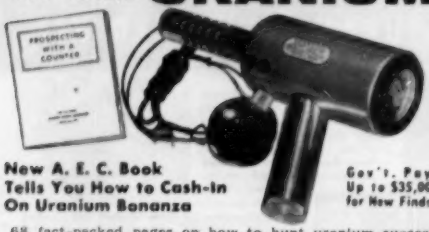

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Will Detroit Build V-6 Cars?

[Continued from page 67]

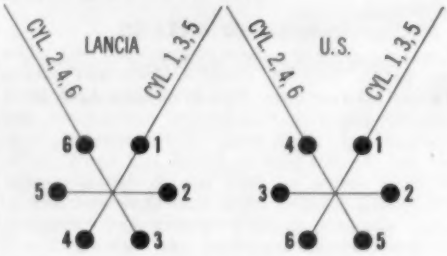
at the front end is near the bottom. So the engine wants to pitch down at the front end, though its center of gravity may not move in space.

This condition of two equal forces acting in opposite directions but at a distance from each other gives rise to what is called a "couple." The chief objection to V-6s has been unbalanced primary and secondary couples.

The trick is to get rid of the changing couples in both banks or neutralize their effects. If this can be done, the primary couple may be balanced out in the crankshaft itself.

It has been done, and in the words of one engineer, "It required the solution of an ugly simultaneous differential equation."

Two ways were found:



DOTS REPRESENT CRANKPINS

Don't confuse crankpin arrangements with firing orders.

The crankpin arrangement on the left is used by Lancia. The one on the right is common in this country on experimental V-6s and has the advantage of lower bearing loads and somewhat easier balancing.

The secondary forces introduce a couple too, rotating at twice crankshaft speed and in the opposite direction. In general, this secondary couple is about a fourth as big as the primary.

Lancia does nothing about it—and Lancia V-6s are neither especially smooth nor quiet. Tests in this country have indicated that V-6 engines without secondary balancers are reasonably satis-

[Continued on page 250]

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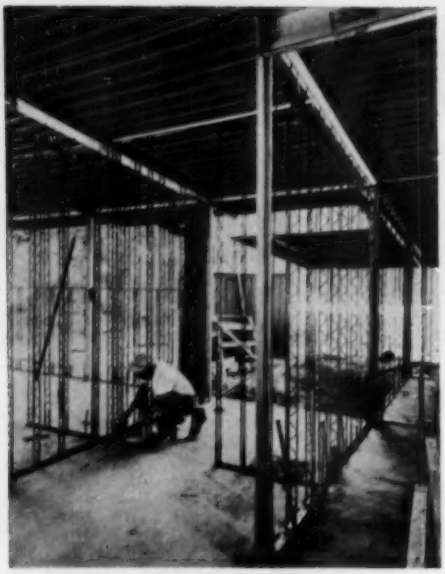

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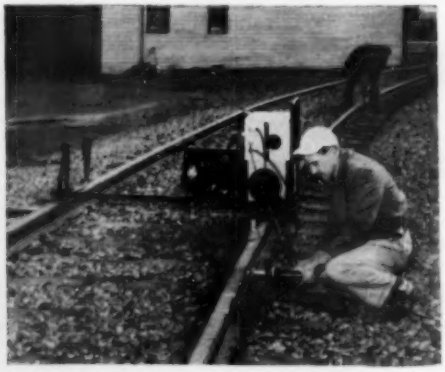

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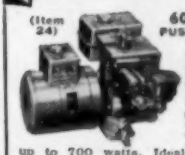

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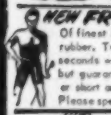

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Eliminates 12 individual items from your Pack or Tool Kit!

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MIDGET MOTORS MFG. CO., ATHENS 2, OHIO

[*Continued from page 242*]

factory. But where the imbalance gets into a sympathetic vibration with the bending frequency of the propeller shaft, it can kick up quite a fuss.

The current tendency is to use secondary balancers. This usually takes the form of a long shaft in the crankcase, parallel to the crankshaft and with end weights at 180 degrees to each other. This shaft "pumps" a second, opposing couple into the crankcase. By timing, it can be made to balance exactly the secondary couple fed into the crankcase by the motion of the pistons. The balancer runs at twice crankshaft speed and in the opposite direction. This neutralizes the couples developed by the pistons.

This seems like a lot of machinery just to remove a little vibration. It is, and one of the serious problems is to provide a quiet gear drive for a shaft turning as high as 10,000 r.p.m.

Why no production? But none of this explains the absence of production V-6s. The engine is compact. As one engineer phrased it, "It's full of guts, with no waste space." Designs built and tested indicate that the V-6 will save at least 15 percent of the weight of a comparable V-8. Weight means dollars.

There are other obvious economies. A piston for a V-6 costs very little more than one for a V-8, and you need only six. The engine can be installed more easily than a V-8, with plenty of underhood space.

Why, then, has such a paragon not been put on the showroom floor? The real answer is that it arrived on the scene a little too late.

The V-6 is a rare recent example of planned discovery. And it's no secret that its proponents worked alone for years in a pretty bleak atmosphere. Nobody was interested in what they were doing. Too many were making sheep's eyes at V-8s, and they probably included every phalanx of the sundry sales departments.

Today, manufacturers who supply both six and eight cylinders in the same car are finding it hard to keep up with the demand for eights. The appeal of extra cylinders is insidious.

"You think Detroit's crazy?" inquired one cynical member of the tribe encamped near the River Rouge. "We've spent millions selling the American public on how good the V-8 engines are. We'd be nuts to spend more millions unselling them."

So the V-6 is here, and it isn't. Detroit can put it into production any time it makes up its mind to.

No one seems willing to make book on a report that GM will put its V-6 into low-cost taxicabs. But if, in its ponderous secretiveness, GM is ready to introduce its engine in *any* kind of a vehicle, it's a safe wager that Chrysler can match it any time it chooses. And probably Ford can, too. END

NEXT MONTH . . .

Building Super Roads

THE unglamorous scene at the left is actually a historic golden-spike ceremony: the first juncture of two state-spanning toll roads. The finished slab is the western tip of the Pennsylvania Turnpike; the fresh mix is the theatrical new Ohio Turnpike. In the September issue, POPULAR SCIENCE MONTHLY will tell—and show—how they built this newest superhighway.

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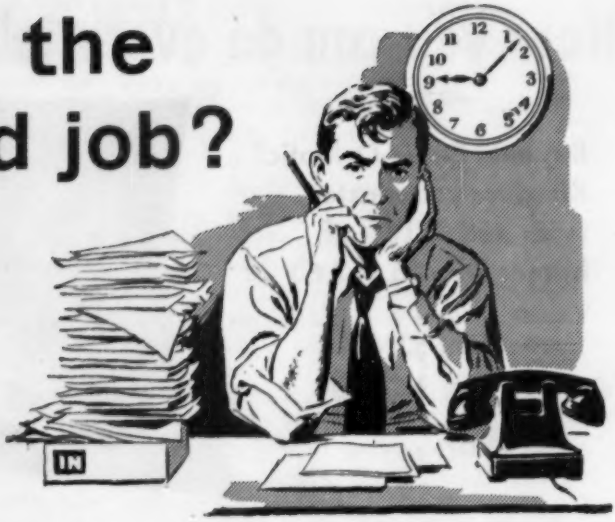

Sure you are. Anybody gets tired of standing still. But don't get the idea that just quitting your present job and going somewhere else will get you out of the rut.

The trouble may be inside yourself. You're burning up energy *worrying* about getting ahead instead of actually getting ahead. You want to make more money, be respected. All right, you *can!*

Look around you. The men who are getting ahead are *trained* men. They've learned special skills that bring higher pay. The men *without* training stick in the same old job.

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